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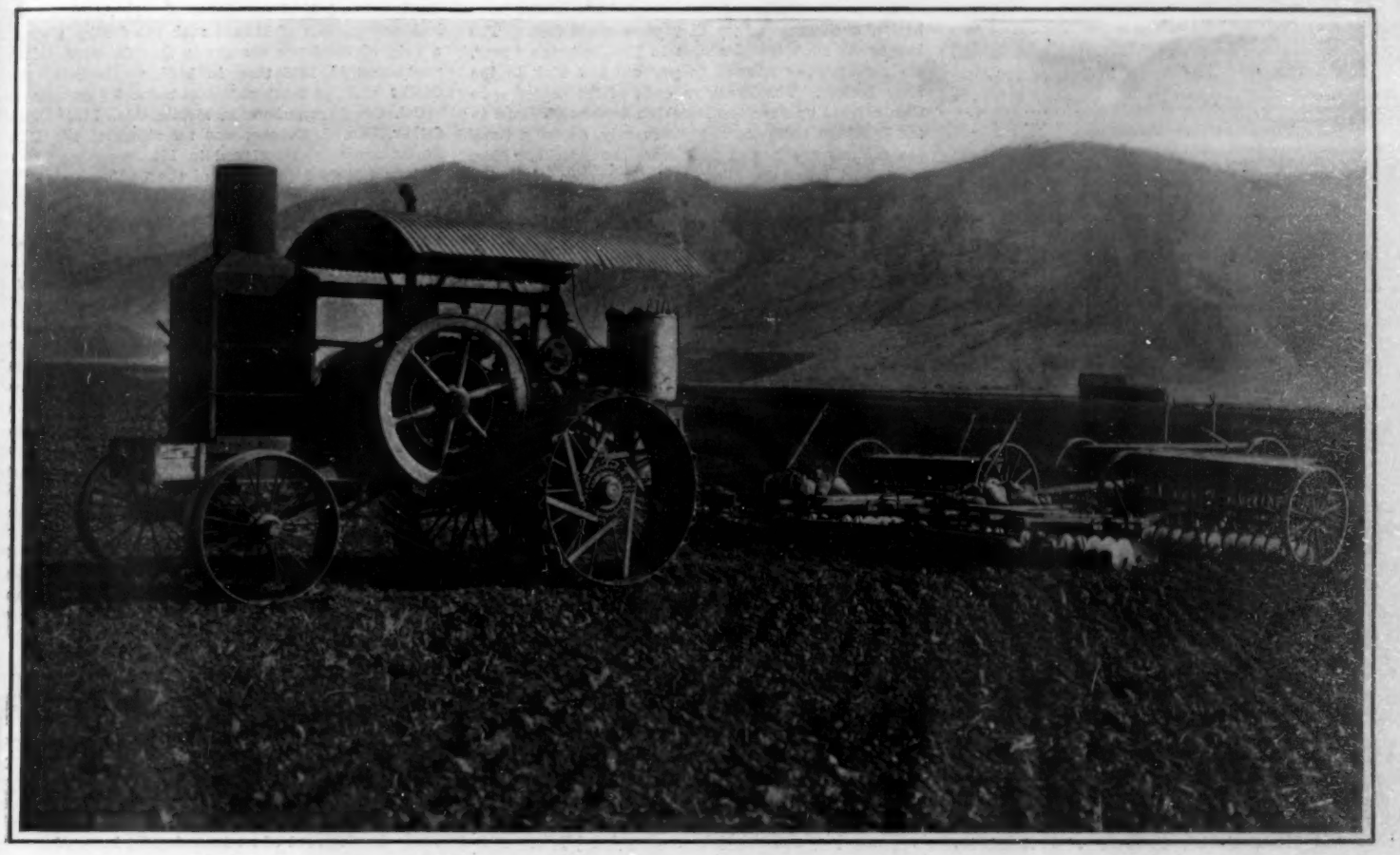

The Gasoline Traction Engine Hauling a Disk Plow.

A Gang Plow Hauled by a Gasoline Traction Engine.

THE TIRELESS MODERN FARM-HORSE AT WORK IN THE FIELD.—[See page 458.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, JUNE 27, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the *facts authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

INSPECTION OF NIAGARA FALLS POWER COMPANY TUNNEL.

The tunnel which discharges the tailrace water of the Niagara Falls Power Plant enters the Niagara River below the Falls, close to the point at which one abutment of the upper steel arch bridge, the longest arch span in the world, is located. Some anxiety has risen regarding this abutment, lest it might have been damaged by the rush of water from the tunnel; and, with a view to making an examination by divers, it was decided to close the gates leading from the river above the Falls to the penstocks of the Niagara Falls Power Company, and so shut off the flow of water through the tunnel.

It is stated that the engineers found the abutments of the bridge to be in good condition. Advantage was taken of the opportunity presented by the shutting down of the intake gates to examine the Niagara Falls tunnel. This was found to be in excellent condition, none of the bricks being out of place, and no signs of erosion being discovered in the whole length of the tunnel. With a view to making the shutdown on the American side complete, the Niagara Falls Hydraulic Power and Manufacturing Company also closed its gates. Consequently, for a period of several hours, all the flow of the Niagara River on the American side was once more passing over the American Falls. Advantage was also taken of these conditions by the government engineers, who made a careful survey to determine how far the flow of water over the American Falls had been affected by the diversion of water for the use of the electric companies.

FIRST CABLE STRUNG ON MANHATTAN BRIDGE.

If the work of stringing the cables and suspending the floor of the Manhattan Bridge be carried through with the same expedition with which the two steel towers have been erected, this greatly-needed structure may be considered to be within measurable distance of completion. In speaking of the speedy erection of the towers, however, we are not to be misunderstood as suggesting that the work of constructing the bridge as a whole has been expeditious. Far from it. The unfortunate change of plans, made when the present administration came in, threw the whole work back several years; and had the original plans, which were for a better type of bridge than is going up, been permitted to stand, the Manhattan Bridge would probably have been open to the public at the present time. However, the preliminary work incidental to the stringing of the main cables was begun last week, and the first of the cables for the working platforms on which the main cables will be constructed, was hoisted into place. The four main cables of the Manhattan Bridge will be the largest suspension-bridge cables ever constructed. Each will consist of 9,742 galvanized steel wires, slightly less than 1/5 of an inch in diameter, and there will be about six thousand miles of wire in each cable. In constructing the cables, the wire will be carried back and forth over the towers from anchorage to anchorage, passing around large spools at the ends of a series of massive eyebar chains which are anchored into the masonry of the anchorages. Practically each cable will consist of a continuous wire, about six thousand miles long, woven from anchorage to anchorage, a distance of over half a mile, with the lengths of wires lying parallel with each other and in exactly the same catenary curve. When the weaving is completed, the wires will be securely clamped together, and covered with a waterproof sheathing to protect them from the weather. Now, in order to secure the proper adjustment of the wires, and perform the work of clamping and sheathing, it is necessary to have workmen strung out along the whole length of the finished cables. To accomplish this, four working platforms, supended on temporary cables, must be built, the platforms having approximately the same curve as the main cables. Each platform will be supported by four wire ropes, 1¾ inches in diameter, footing for the workmen being provided by means of a plank runway about three feet in width.

The method of stringing these cables was as follows: Four spools containing the cables were placed on a barge against the piers of the New York tower, the inshore end of the cables having previously been carried over the Manhattan tower and down to the Manhattan anchorage, where they were made fast. The barge was then towed across to the Brooklyn tower, the cables being allowed to pay out and sink to the river bottom. The Brooklyn ends of the cables were then carried up over the Brooklyn tower and down to the Brooklyn anchorage. Subsequently, one at a time, the cables were hauled taut from the Brooklyn side, and lifted from the river to their proper curve between the towers. It is anticipated by Bridge Commissioner Stephenson that these temporary foot bridges will be completed by August, when the weaving of the main cable will at once commence.

THE GAS DRIVEN WARSHIP.

Although we do not altogether credit the report recently cabled from England, to the effect that the British Admiralty had placed an order for the construction of a 20,000-ton battleship to be driven by gas engines, there is a certain amount of plausibility given to the statement by the fact that at the session of the Institution of Naval Architects held in the spring of 1907, the well-known naval architect, James McKechnie, of Vickers, Sons & Maxim, presented a design for a powerful battleship carrying ten 12-inch guns, whose motive power consisted of gas producers, and four sets of 10-cylinder gas engines, driving four propellers. The paper went quite fully into the question of weights, space occupied, and steam consumption, an interesting comparison being made between the 16,000-ton "King Edward" and the Vickers design for a 16,000-ton gas-driven battleship. So marked was the gain in weight and space, that not only did the new ship carry ten 12-inch and eighteen 4-inch guns as against four 12's, four 10's, and twelve 6's, carried by the steam-driven "King Edward," but there was shown a remarkable series of economies in other very important directions. Comparison was made at the same time with a ship propelled by oil engines, and it was found that the weight of machinery for the steam engine ship was 1,585 tons, including water in the boilers; for the gas engine ship, 1,105 tons, including water in jackets and piping; and only 750 tons, including water in jackets and piping, for the 16,000-ton ship driven by oil engines. The area occupied by the steam engines was 7,250 square feet; that required by the gas engine equipment would be 5,850 square feet; while the oil engines would require only 4,110 square feet. At full power, fuel consumption per indicated horse-power per hour would be, for the steam engine, 1.6 pound; for the gas engine, 1 pound; and for the oil engine, 0.6 pound.

In view of the fact that a complete design for a battleship driven by gas engines was worked out over a year ago by a leading English firm, after several years' experimental work in the production of a successful marine gas engine, it is not altogether improbable that the British government have placed, or are contemplating, an order for a ship of this kind. The dispatch further states that the new ship is to carry 13½ inch instead of 12-inch guns. A 45-caliber 13½-inch gun would have far greater punishing power, at the great ranges at which future naval engagements will be carried on, than the 12-inch piece; and this advantage would be gained without any appreciable loss of speed of fire under the conditions which will obtain during an engagement.

BRILLIANT MEDICAL WORK OF COL. GORGAS AT PANAMA.

There is every evidence that the United States army is establishing a great record for itself in every department of the work of constructing the Panama Canal. The story of rapid progress, as told in the periodical reports, comes in refreshing contrast to the vacillation, misunderstandings, and too-frequent resignations of the earlier period of control by civilian engineers. The government can ask for no stronger appreciation by the American people than is afforded by the fact that distrust and apprehension have given place to a widespread confidence, unbroken by a single word of criticism.

It is not stretching the limits of praise too far to say that the most brilliant success achieved at Panama is to be credited to the work done by the Army Medical Corps, under Col. W. C. Gorgas, in the extermination of yellow fever and malaria, and the betterment of the general sanitary conditions. When the Medical Corps took charge the Panama Canal had become synonymous with disease and death; but today, thanks to the system introduced by the Medical Corps, the zone of operations is as healthful as the average city in the United States. But the facts are best told in the succinct language of the last monthly report: "The general death rate for the Zone (including Panama and Colon), 20.04 per thousand, is about a fair death rate for a healthy city of the United States. While a great many of our cities have a smaller death rate than this, a goodly number have a larger death rate. In April, 1907, we had a population of 97,815, with 334 deaths, giving us a yearly death rate of 40.97 per thousand. In April, 1908, we had a population of 116,178 with 194 deaths, giving us a rate of 20.04 per thousand; that is, with a larger population in 1908 than in 1907, we had 140 fewer deaths, and the death rate was reduced just one-half."

Col. Gorgas was born in Mobile, Ala., in 1854. His father, Gen. J. Gorgas, was an officer of the United States army, who resigned in 1861, went South, and became Chief of Ordnance of the Confederate States. He received his collegiate education at the University of the South, Sewanee, Tenn., getting the degree of A.B. there in 1875. He graduated in medicine at Bellevue Hospital Medical College in 1879, and entered the army in 1880. He was health officer of the city of Havana during our first occupation of Cuba from 1898 to 1902. While he was in this position, the board of which Dr. Reed was chairman made the discovery that yellow fever in nature was transmitted only by certain species of mosquito. Measures based on this discovery were first put into effect in Havana. They were promptly successful, and the city was freed from fever in the first year of this work. Col. Gorgas has been in charge of the health work at Panama since the inception of that work, or from March, 1904, to the present time. The same results have been accomplished there, and the Isthmus has been freed from yellow fever, no cases having occurred there since May, 1906. The general health of the force has been so protected, that it is about as good as that of the same number of men working in the United States. For the work in Cuba, Congress in 1903 passed a special bill raising Major Gorgas to the rank of Colonel. As a recognition of the work in Panama, the President early in 1907 made him a member of the Isthmian Canal Commission. The latest recognition of his work was his election a few weeks ago as president of the American Medical Association at their recent meeting in Chicago.

AN INCANDESCENT LAMP WITHOUT A VACUUM.

The development of an incandescent lamp of greater efficiency than those supplied with the ordinary carbon filament is taking place along several different lines and with varying degrees of success. Already we find various high-efficiency lamps in commercial use, and giving greater or less satisfaction, while, in the laboratories, still further efforts are being made to meet the requirements of economy and satisfactory illumination. Most of the present high-efficiency lamps employ a metallic filament such as tantalum or tungsten; but distinctly different from these is a lamp where the filament of carbon is replaced by one of "helion," as the inventors term a new material whose principal constituent is silicon, but whose exact constitution is yet to be determined. Its properties, however, especially its melting point, are absolutely different from the recognized forms of silicon. Used in this way, helion possesses many interesting characteristics, and very recently, in the course of the practical development of these lamps, it has been found possible to dispense with the usual high vacuum within the bulb if these filaments are employed. This at once widens materially the range of usefulness of electric incandescent lamps, particularly under circumstances where the lamps are exposed to shocks and concussion, as on a battleship, or in the emplacements of coast defenses where high-power guns are fired. Another interesting circumstance noted by the inventors is that the material of the filament is neither crystalline nor graphitic silicon, the usual forms in which this element occurs when not amorphous. It doubtless exists here in an allotropic form not previously recognized, a fact emphasized by the difficulties experienced in securing helion unmixed with carbon.

Although the helion lamp does not depend upon a vacuum within the bulb, in its ordinary construction it does not differ essentially from the ordinary carbon filament lamp, save in the nature and composition of the incandescent filament. This is of much shorter length and greater cross section, because the resistance of the helion is approximately fifty times that of the ordinary carbon filament and three hundred times that of tungsten. Consequently, several filaments may be arranged in parallel in order to give increased candle-power; and a special form of lamp has been devised, where the burning out or breaking of a single

(*Concluded on page 458.*)

THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

The summer constellations are now to be seen at their best, and we shall find that they afford an interesting evening's study, even though the observer may have nothing more to aid his vision than an ordinary field glass.

At first, rejecting the aid of even such a simple instrument, we may use our eyes alone, and seek to become acquainted with the principal constellations.

Let us begin by facing due south. Right before us is Scorpio, the finest of the twelve zodiacal constellations, and one of the easiest groups in the sky to recognize. We never see it in its full glory, for it is far south of the celestial equator, and the brightness of its stars is dimmed by the absorption of the great thickness of air through which we must look to see them. But even so, it is a very fine sight on one of the clear evenings which are frequent at this season, especially if the moon is out of the way.

Our map shows us what to look for: The bright red star Antares, with a smaller one on each side of it; the vertical line of three second-magnitude stars on the right, and the long tail on the left, which curves down close to the horizon and then rises again to end in two bright stars; the whole configuration bearing a striking resemblance to the creature for which it is named.

To the right of Scorpio are some of the stars of Centaurus, whose brightest ones we never see. To the left is Sagittarius, which contains the small but conspicuous Milk Dipper. The Greek letters appear to be assigned to the stars of this constellation almost at random, departing very far indeed from the usual order of brightness.

Capricornus and Aquarius, which are just rising, can be seen better later in the evening, or at the same hour later in the year. Above them, however, is a group of constellations which can be well studied now. Aquila, the Eagle, contains one first-magnitude star, Altair, which has a smaller one on each side of it somewhat like Antares, but can be distinguished from that star, not only by its place in the sky, but because it is white, while Antares is extremely red.

North of this are two small but ancient constellations, Delphinus and Sagitta. The latter bears considerable resemblance to the arrow which it is supposed to represent. The former does not look much like a dolphin, but the little group of four third-magnitude stars, sometimes called "Job's coffin," is unmistakable.

North of these is the much larger and finer group of Cygnus, and above this is Lyra, whose brightest star, Vega, is more than twice as brilliant as Altair—that is, to our eyes. It is really more than twice as far away as Altair, and its intrinsic brilliancy must be fully tenfold as great.

The three brightest stars of Cepheus, which lie still farther north, form a very oblique triangle. Beyond them we come to the familiar zigzag line of Cassiopeia, low in the north.

The Milky Way runs all through these constellations. Note particularly the dark spaces across it in Cygnus, looking almost as if it was obscured by patches of cloud; the doubling of its stream all the way thence to the southern horizon, and the great star clouds in Sagittarius, which make the region between this constellation and Aquila one of the most remarkable parts of the sky.

The constellations to the west of those we have described are already more or less familiar from their descriptions in recent months. Hercules, Corona, and Bootes are clustered round the zenith. Ophiuchus and Serpens are south of them, as is also Libra, and Virgo southwest. Leo is near setting in the west. Ursa Major is descending toward the northwestern horizon, and Draco and Ursa Minor are high up above the Pole.

Before turning to pick up our glasses, we may test our eyesight upon some wide double stars, now visible in different parts of the sky. First take the star *Zeta* in Ursa Major. This has a fifth-magnitude companion at a distance of 11½ minutes of arc, which is very easily seen on a clear night by an ordinarily good eye. If this test is passed, turn next to Capricorn, when the star α has a much closer companion, distant 6 min., or to Scorpio, where the star μ, in the tail below Antares, is a somewhat similar pair.

A more difficult pair is found in Cygnus. Between the stars α and β are two smaller ones near together. The southernmost and brightest of these has a companion which, though not much nearer than those of the last-named stars, is a good deal fainter, and so forms a severer test for the eye.

Finally let us turn to Lyra. The northernmost of the two small stars close to Vega is a still closer pair, its two components being separated by 3½ minutes of arc. To see this double without optical aid requires an unusually keen eye, but the smallest opera glass reveals it at once. With a good field glass the two stars seem widely separated. With such aid we may now turn to Draco. Near the two bright stars β and γ are two others, which form with them an irregular quadrilateral. The faintest of these is double, but a much closer pair than any at which we have so far looked, the distance being only one minute of arc. This is about as close a pair as an ordinary fieldglass will divide, but from the standpoint of the telescopic observer it is very wide. Indeed, with large telescopes a pair would not be considered really close unless its distance was less than 1/100 of that separating the two stars of which we are speaking.

At 11 o'clock: June 7.
At 10½ o'clock: June 14.
At 10 o'clock: June 22.
At 9½ o'clock: June 30.
At 9 o'clock: July 7.
At 8½ o'clock: July 14.
At 8 o'clock: July 22.

NIGHT SKY: JUNE AND JULY

THE PLANETS.

Mercury is in inferior conjunction with the sun on the 4th, and Venus on the 5th, at which times these planets change from evening to morning stars. Neither of them can be seen with the naked eye till the latter part of the month. Mercury reaches elongation on the 25th, and may then be seen before daybreak, rising about 3:30 A. M.

Venus gets well away from the sun before the end of July, and is conspicuous in the morning sky, rising about 2:45 A. M. Mars is slowly approaching conjunction, and is lost in the twilight all through the month.

Jupiter is evening star in Cancer, setting at about 9:30 P. M. on the 1st, and before 8 P. M. on the 31st.

Saturn is in quadrature with the sun on the 1st, and is observable in the small hours of the morning.

Uranus comes to opposition on the 7th, and is well observable. He is just visible to the naked eye on a clear dark night, and may easily be picked up with a fieldglass. He may be found just south of the star τ Sagittarii (shown on the map). This star has two fainter neighbors which form with it a small obtuse-angled triangle. Uranus at the time of opposition makes a nearly equilateral triangle with the left-hand two of these three. His slow eastward motion, relative to the stars, will make the identification certain.

Neptune is in conjunction with the sun on the 6th, and therefore invisible.

THE MOON.

First quarter occurs at 3 P. M. on the 6th, full moon at 5 P. M. on the 13th, last quarter 7 A. M. on the 20th, and new moon at 2 A. M. on the 28th. The moon is nearest us on the 14th, and farthest off on the 2d, and again on the 29th. She is in conjunction with Uranus on the 13th, Saturn on the 18th, Venus on the 25th, Mercury and Neptune on the 26th, Mars on the 28th and Jupiter on the 29th.

Princeton University Observatory.

REDUCTION OF FOREIGN PARCEL POSTAL RATES.

Postmaster-General Meyer has announced that on and after July 1 next parcels having a weight limit of eleven pounds (a gain of seven pounds over present limit) may be sent from the United States by parcels post to England and Italy August 1 at the rate of twelve cents per pound; also to France July 1, weight limit 4 pounds 6 ounces. The present rate is 16 cents a pound. Coming as this does soon after the announcement of the two cents per ounce letter ocean postage to take effect October 1 next, it is safe to predict a large increase of trade will take place in small articles between the respective countries in a way more convenient and quicker than the usual express and freight method. The convenience of postal transportation is that a parcel is delivered directly to each party by the postal agent without delay.

In England, where postal rates are on a practical basis, parcels are sent to any of its distant possessions by mail at the rate of three pounds for 24 cents, seven pounds for 48 cents, eleven pounds for 72 cents, a rate of eight cents per pound, which is the general world rate and is one restricted in the United States only to printed books. The actual cost of transportation of merchandise through the mails has been ascertained to be but 4½ cents per lb.

The third aeroplane of the Aerial Experiment Association has just been completed at Hammondsport, N. Y. This machine is constructed along the same general lines as the two previous ones, and the first trials of it are being made as we go to press.

DELAGRANGE TO COME TO AMERICA.

On June 18, after he had repaired the motor of his aeroplane, M. Delagrange made a number of flights in the presence of a crowd estimated at nearly 100,000 people, above the Piazza d'Armi, at Milan, Italy. The first flight was made shortly before 6 A. M., the aeroplane remaining in the air for about five minutes and making several turns about the Piazza. Several other trials were made, but these were not so successful, as the machine was not in the air more than two or three minutes at a time. M. Delagrange expects M. Farman will arive at Milan shortly and compete with him. The former aviator is also said to have contracted with the St. Louis Aero Club, to visit America this summer. Should he arrive here in August, there will no doubt be some interesting contests between Delagrange and the Wright Brothers. Mr. Wilbur Wright is reported to have engaged a field at Le Mans, in France, where he will make a demonstration with his aeroplane shortly.

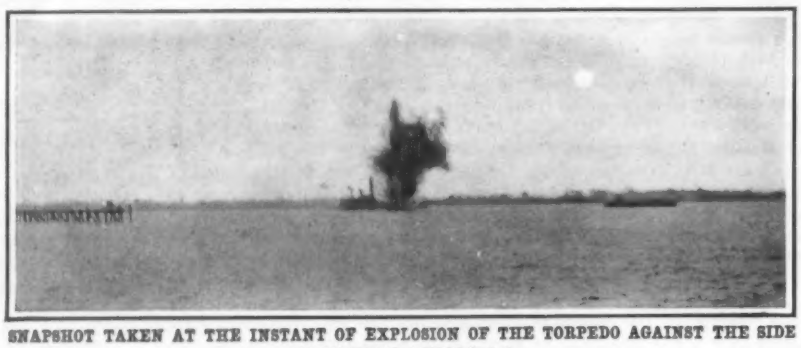
TORPEDO ATTACK ON THE MONITOR "FLORIDA."

In our issue of June 6, 1908, we described the first of the important tests of the monitor "Florida," which have been made by the Navy Department to determine the amount of injury which will be wrought upon a warship by the two most powerful of modern missiles, the 12-inch armor-piercing shell and the Whitehead torpedo. The attack by shell was directed against the inclined port plate of the 12-inch gun turret, and although, in the case of the "Florida," this plate was made under the old Harvey process and was not possessed of more than 75 per cent of the resisting power of the best modern Krupp plates, the shell failed to penetrate, and the turret mechanism received no serious injury. In the accompanying illustration of the "Florida," taken at the conclusion of the recent test, the turret plate has been removed, and the opening into the turret is seen to be covered by a tarpaulin.

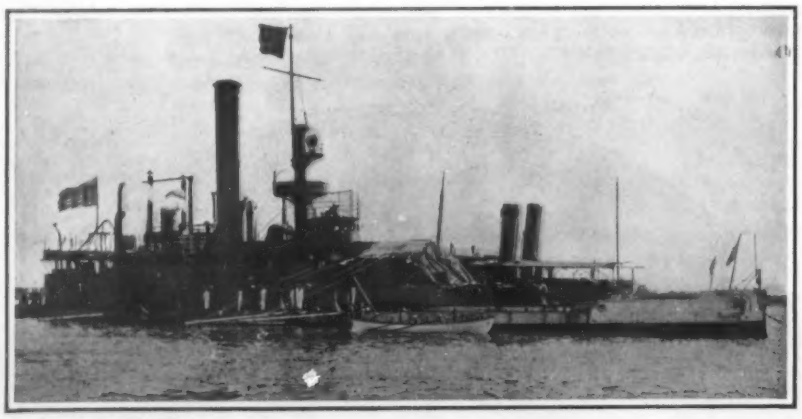
The second test, which was completed last week, was arranged with a view to ascertaining how far the modern system for preserving the stability and flotation of a battleship, by means of interior bulkheads and subdivisions, is correct. The interior of a warship below the water line is subdivided into compartments of such a limited size that any one, or, in the case of the larger ships, more than one, may be flooded without sending the ship to the bottom, or, indeed, without so badly crippling her that she could not maneuver or fight her guns to advantage. There has always been the possibility, however, that the detonation of the torpedo might prove sufficient, not merely to blow in the side of the ship, but also to wreck the walls of the compartments thus penetrated, or at least to so badly start the seams that there would be a heavy leakage of water into adjoining compartments.

In preparation for the attack, the "Florida," which is one of a class of four monitors of 3,225 tons displacement, completed in 1902 and carrying two 12-inch breech-loading rifles apiece, was anchored in quiet water below Sewell's Point, about half a mile to the south of the Jamestown Exposition ground. Directly off the starboard side, and distant about four hundred feet, was anchored a coal barge shown in the accompanying illustration, from which the torpedo was fired. To insure that the torpedo would strike at the exact spot desired, abreast of one of the coal bunker compartments, a trolley wire was strung from the barge to the monitor; and with a view to obtaining all possible information from observation close at hand, Rear Admirals Mason, chief of the Bureau of Ordnance, and Capps, chief of the Bureau of Construction, together with Commanders Chambers, Quimby, and Diffenbach, and Assistant Naval Constructor McEntee, took up a position within the superstructure of the "Florida," about fifteen or sixteen feet above the level at which the torpedo was to strike. To the westward of the line of fire was a tug upon which were the Secretary of War, the Secretary of the Navy, and other government officials, and a large number of naval officers. To the rear of the firing barge was stationed the torpedo boat "Morris," whose commander, Lieut. Babcock, was to start the torpedo. On the receipt of a signal the torpedo was fired, and, traveling at a speed of about 28 knots an hour, it struck the side of the monitor below the belt, at a depth of about 8 feet below the water line. Immediately there was the loud roar of the explosion, and a huge column of water, mingled with fragments of the torpedo, was hurled skyward, presenting the appearance shown in our illustration.

Since this costly experiment was carried out for the purpose of obtaining valuable information for the use of our ordnance officers and naval constructors, the technical results are very properly being carefully guarded; but according to the censored press reports which have appeared, and the comments made by naval officers, the test proved to be an indorsement of the principles of torpedo defense construction as embodied in the under-water bulkheading and general compartmental construction of our ships. It is stated that the damage was confined to the single compartment, which was penetrated, and that the inrush of water was so far controlled that the "Florida" showed but a moderate list to starboard after she was torpedoed. The officers who were on board the "Florida" state that the only sensation they experienced was that which might be caused by a comparatively mild earthquake shock, and that the noise of the explosion was not unlike that of a violent thunder clap. It was admitted that although the "Florida" might have been sunk by this torpedo, had the blow been received on the open sea and in rough weather, a similar injury to a large modern battleship at sea would have failed to sink her and, indeed, would not have prevented her from continuing to fight all of her guns. The chief damage to the ship would consist in the change of trim and loss of speed which would result from her lower flotation.



SNAPSHOT TAKEN AT THE INSTANT OF EXPLOSION OF THE TORPEDO AGAINST THE SIDE OF MONITOR "FLORIDA."



Photographs by C. P. Wiston.

The torpedo struck on the starboard side amidships. Note the tarpaulin over turret whence port plate, damaged in 12-inch gun attack, has been removed.

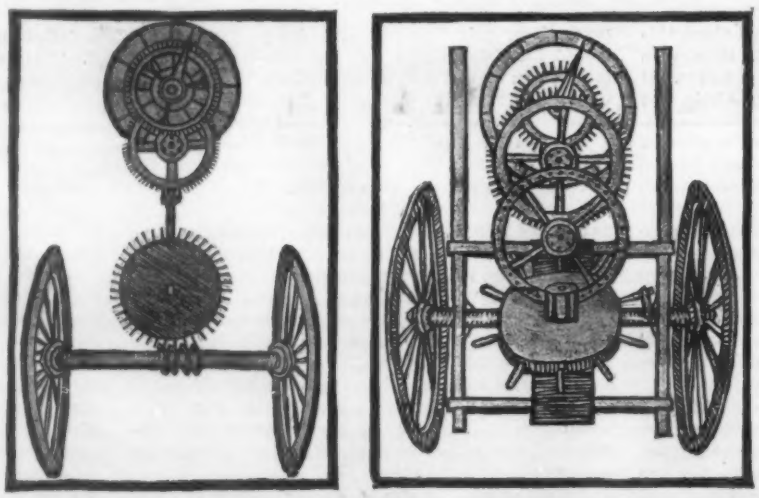
A NEAR VIEW OF THE "FLORIDA" AFTER THE ATTACK.

Consul-General Richard Guenther, of Frankfort, furnishes the following information, published in a German journal, concerning the invention of a Trinidad planter for the manufacture of paper from sugar-cane bagasse: For a long time the bagasse had been experimented with in order to make cellulose out of it for paper manufacturing, but without success. It is now reported that a Trinidad sugar planter has, after several years of experiments, arrived at the conclusion that a superior article of paper can be made from the bagasse of sugar cane, as also of the bagasse of other plants of that district. It is stated that he has erected paper works in connection with his sugar factory at an expense of $85,000. The bagasse, after having been three times ground and pressed in sugar presses, is carried, automatically, to the paper mill and is there treated by a process of the inventor. It is then boiled for several hours, passed through rotating millstones, put into the usual machines for manufacturing paper pulp, and afterward cut up under hydraulic pressure. The inventor claims that 84 per cent of the bagasse is transformed into paper pulp, and he believes that his invention will revolutionize the cane-sugar industry, as it would be remunerative to plant sugar cane primarily for making paper, with the sugar as a by-product. Sugar making would again become very remunerative, as bagasse, for fuel, had approximately a value of only about $1.80 per ton. The cost of paper production by this process is said to be very low, as the surplus steam of the sugar mills can be utilized. The value of the paper made from the bagasse is estimated to be $24 per ton. During the time that no sugar is made the paper mill is kept running by using other materials found in the district for paper making, banana bagasse, paragrass bagasse, and that of other fibers.

A Roman Taximeter on a 17th Century Carriage. A Drawing by the Ingenious Alessandro Capra.

THE TAXICAB IN OLD ROME.

M. George Servant has just made an interesting discovery. In a book which bears the title "La Nuova Architettura Famigliare di Alessandro Capra, Architetto e Cittadino Cremonese," and was published at Bologna in 1678, he found the illustrations reproduced here. Investigation proved that the drawings were by Capra, and were designed to show the mileage recorder of Vitruvius, military engineer under Cæsar and Augustus, as Capra imagined it to have been. "Fix on the wheel of the car," says the Roman architect, "a disk bearing on its circumference a single cog-wheel working into another disk having 400 cogs. On the side of this second disk, a cog larger than the others will set in motion a horizontal disk, which also bears 400 cogs, and is furnished besides on its flat part with a certain number of holes in which there are little balls; these will fall one by one into a tube, when the rotation of the disk will lead them to its orifice; they will then reunite in a brass vase. One ball falling after each mile traversed, the number of miles done in a day will be known by counting the balls."



Did Cæsar and Augustus Know the Taxi-Chariot? The Mileage Recorder Invented by Vitruvius (According to a 17th Century Reconstruction).

THE TAXICAB IN OLD ROME.

Within a short time a Marconi wireless station will be established on the roof of the Bellevue-Stratford Hotel in Philadelphia, so that guests may communicate with their friends at sea. If the plant works successfully, a similar one may be put into operation on the roof of the Waldorf-Astoria in New York.

SEEING FROM PARIS TO ROME.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

For the last thirty years inventors have been vainly endeavoring to solve the problem of electrical vision at a distance, which is related but not identical with tele-photography, or the transmission of pictures. M. Jules Armengaud has recently suggested a method which appears promising.

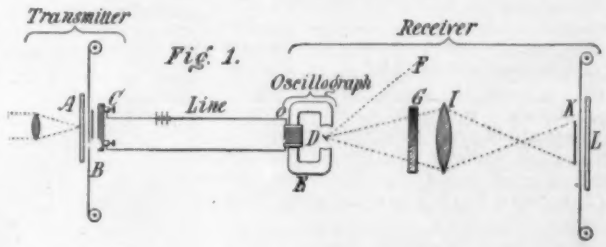
The problem, by the way, has long been solved on paper. M. Armengaud, himself, in presenting Bell's photophone to the Société des Ingénieurs Civils in 1880, pointed out the results that might be expected from the employment of selenium, and cited the experiments of De Paiva, Senlecq, Ayrton and Perry, Deprez, Leblanc, and Bréguet. This was shortly after the Bell telephone had demonstrated the possibility of transmitting and reproducing waves of sound by means of wires and electric currents. Naturally the application of similar methods for the transmission of luminous vibration suggested itself.

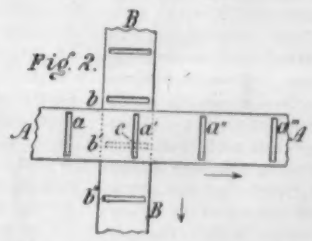
The electrical conductivity of selenium varies with the intensity of the illumination to which it is exposed. Hence a sort of artificial retina can b made of the selenium, which, like the retina of the eye, will react to the varying degrees of light and shade of an image projected upon it, the reaction taking the form of variations in the strength of an electric current flowing through a wire comparable with the optic nerve. At the other end of the wire it would be necessary to reconvert the variations of current strength into variations of luminosity and to redistribute these in accordance with the geometrical plan of the original image or object. Methods of accomplishing this have been devised by Korn, Belin, Berjonneau, and other experimenters in telephotography, but these methods do not make possible direct vision at a distance, for the current variations corresponding with the various parts of the image are necessarily transmitted singly and successively, while in direct vision all parts of the object are seen simultaneously. This difficulty can be overcome by making use of the persistence of luminous impression on the retina of the eye. If the various parts of an object are presented successively to the sensitive selenium cell with such rapidity that the whole object is, so to speak, explored in the fraction of a second, the sensation produced in the eye of the observer at the receiving station by the first part of the object (through the medium of the selenium cell, the connecting wire and the receiving apparatus which converts electrical into luminous effects) will not have become effaced when the sensation due to the last part of the object is produced.

It has hitherto appeared impossible to attain the requisite rapidity of transmission and reception. Ingenious but fruitless attempts were made by Weiller in 1889, Dussaud in 1898, and Coblyn in 1902. Armengaud has now attacked the problem by a method suggested by the moving picture machine, using apparatus similar to that employed in giving to moving picture films their very rapid but interrupted motion.

M. Armengaud wishes to have the passage of all the points of the image take place with a speed so great that the whole image is covered within the space of 1/10 second. The receiving instrument is supposed to respond exactly to these variations, and may have an oscillating mirror which throws the light upon a screen in the proper way. To realize his end, Armengaud divides the image into a series of minute squares and exposes them successively with great rapidity to the selenium cell. M. Armengaud has thus far devised only the transmitter of his system, an ingenious device for covering all the luminous points of a given image at a very high speed. M. Armengaud then hopes to take up the study of the effect of such an apparatus upon the selenium and the formation of the variable currents in the line. Should these be produced in the proper way, it remains to devise the receiving apparatus. These two stages are the most difficult in the solution of the problem.

M. Armengaud's transmitter, which is illustrated in our engravings, consists essentially of a high speed shutter arranged so as to present each point of the image in succession before the selenium. This is done by the use of two continuous bands, one vertical and the other horizontal, which are placed between the image and the selenium. The bands are operated to pass along before the image at a very high speed. This will be understood from the diagram, Fig. 1, in



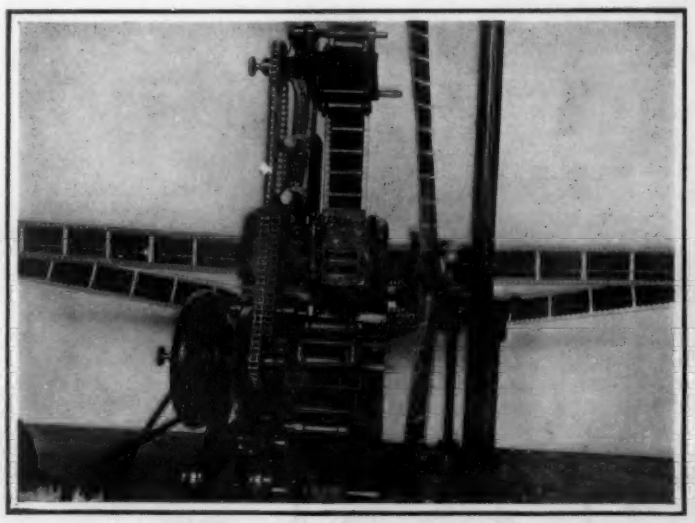


The Principle of M. Armengaud's Apparatus for Seeing Electrically at a Distance.

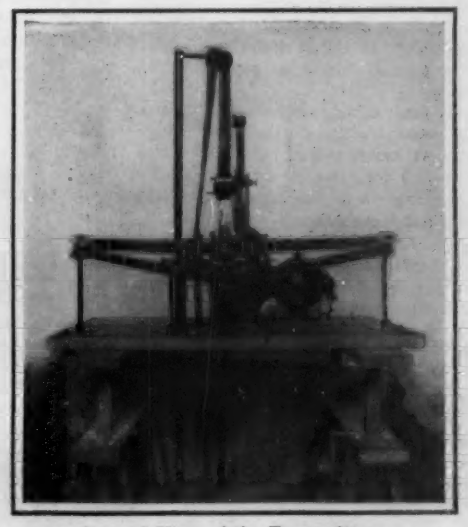
which the image is formed by a lens upon the screen *A*. Behind the screen is placed the selenium cell *C*, so as to receive the light. Between the screen and the selenium are placed the two bands which constitute the shutter, *B*, arranged so that there will be a single opening in the form of a small square between the image and the selenium. This opening is displaced from right to left and again from top to bottom so as to pass successively over the whole image, an arrangement which is shown in Fig. 2. *AA* (Fig. 2) is an endless film such as is used for the cinematograph, the film having been exposed to the light and developed, so that it is black. In the film are cut a certain number of vertical slots, *a*, *a'*, *a''*, equally spaced along the band. Behind the first horizontal band is a vertical band *BB*, which moves in the same way as the former, being mounted on rollers and driven either by hand or by a motor. The band *BB* has a series of equally-spaced horizontal slots in it. The space covered by the intersection of the two boards represents the area of the image. With the vertical band *BB* in position 1 and stationary, as here shown, when the horizontal band *AA* is passed along, only a single square of the image will be uncovered at once, as seen at the intersection of the slots at *C*. This space will move rapidly across the image from left to right, thus allowing the light from the successive points in this line to pass through the shutter and fall on the selenium. The band *BB* is then shifted down by the length of one space, so that its slot *b* comes over a new part of the image. This part is again swept across by the succeeding slots of the band *AA*, and so on. In order that the slot *b* should not come exactly in the position occupied by *b'*, but above it, slots in the band *B* are spaced at a constantly decreasing distance apart.

The band *BB* is made to travel slowly, while the band *AA* moves rapidly so as to sweep across the image at each movement of *BB*. In this way the whole image is covered within 1/10 second. and at the end of this time the process is repeated, so that the eye placed back of the shutter will perceive a continuous image. The selenium cell will thus receive a very rapid succession of light-impulses, and the receiver will reproduce these in the same succession and the same time, so that the image in the receiver will appear to be continuous. The movement of the band *AA* is not intermittent in this case, but is continuous, like an ordinary belt, and this movement will no doubt be sufficient to produce the desired results. The band *BB* on the contrary should come to a full stop at each passage of the slot, and this is carried out as we find in the moving picture machine. In his experimental apparatus, the inventor uses an image of 0.8 inch height by 1.0 inch length, divided into 130 small squares. He finds that the horizontal band should travel at 200 inches per second and the vertical band at one-half that speed. In order to overcome the inertia of the selenium, he proposes to use a number of selenium cells, such as four, six or a greater number, these being rotated about a common axis so as to present one of the cells to the light while the others are in the dark and in a state of repose. Each cell thus has a certain time to recuperate before it is again exposed to the light.

For the receiver, it is proposed to use the principle brought out by M. Belin, combined with an oscillograph *O*. A mirror *D* is oscillated rapidly under the succession of current impulses by means of an electromagnet *E*. It receives a beam of light coming from *F* and reflects it on the screen placed at the right. In the path of the reflected beam is a graduated screen *G* of varying opacity which lets more or less light pass through it according to the position of the beam. This light is thrown on the screen *L* by means of the lens *I* and before the lens is a set of moving bands *K* corresponding to the above-described set, and moving at the same speed. Such an arrangement, if it can be realized in practice, would give the reproduction of the image on the screen.



Detail View of the Transmitting Mechanism.



General View of the Transmitter.

Danger in Sterilized Absorbent Cotton.

Absorbent cotton is now prepared in factories, on a large scale. The raw cotton is carded, freed from grease by washing with soda, bleached with hypochlorites, and finally washed with dilute sulphuric acid. It is then dried, put into packages and "sterilized." But after each of the preliminary operations, it is washed in water, and for this purpose the manufacturer uses any water that is available, in some cases that of more or less stagnant ponds. In this way a great number of microbes is introduced into the cotton and the insufficiency of the supposed sterilization is demonstrated by the startling results of M. Nennette's investigation of commercial brands of absorbent cotton, marked "aseptic" and "sterilized at 120 degrees" (Centigrade). Cultures were made with every precaution of modern asepsis from thirty packages purchased at random. In every instance flourishing colonies of molds, yeasts and microbes of various kinds were obtained. *Bacillus subtilis*, *Bacillus coli*, *Staphylococci* and *Streptococci* appeared in all the cultures, and two of them yielded typhoid bacilli. These results prove that it is unsafe to apply commercial absorbent cotton to wounds or in edema, erythema, and other inflamed conditions of the skin.

The American and Canadian section of the International Waterways Commission have been unanimous in their findings. They advise stringent limitations on the amount of water which may be diverted from the Great Lakes by the Chicago canal, and the amount to be diverted for power purposes at Niagara.

THE MODERN FARMER'S TIRELESS HORSE.

BY FRANK C. PERKINS.

The remarkable development of the gasoline and kerosene motor during the past few years has resulted in its use on American farms to a great extent for pumping water, sawing wood, and other service about the farm, where a stationary motor can be utilized to advantage. This modern labor-saving device has been successfully applied to traction service on the farm, and has taken the place of both men and animals.

The gasoline traction engine for plowing marks one of the latest steps in the evolution of farming during the past several decades. Tractors are now extensively employed, not only for breaking the land, but also for double disking, seeding, and cutting grain.

It is well known that the cultivation of the large farms so common in the great American wheat belt, lying west of the Mississippi River, requires large numbers of men and horses. The up-to-date farmers have turned to the traction engine to take the place of men and horses in these large farming projects. The first traction engines used for plowing were the ordinary steam threshing engines, built primarily for belt service, and their use involved numerous expensive breakages and many discouragements. Consequently, the traction engine has been made more substantial. Steel or semi-steel gearing has been substituted for cast iron, with the result that the steam plowing engine of to-day is much more massive in construction than the threshing engine. In fact, the service is so severe, that no engine can be successfully used for this purpose unless especially designed for it. In other words, no ordinary threshing engine can be a successful plowing engine. On the other hand, the plowing engine is most successful as a threshing engine.

Although the steam plowing engine has achieved success, it is hampered by many inherent difficulties. In the first place, it requires a considerable force of men and horses to keep it in operation and to supply it with fuel and water. It so happens that where traction engine plowing is most desirable, fuel is high priced, and water is often unfit for boiler uses, and moreover has to be hauled considerable distances. It is not uncommon to find steam plowing outfits at work where three four-horse teams are required to keep them supplied with fuel and water. Localities are unknown where two teams are not required for this purpose. The engines stand idle at least twenty per cent of the time, taking on coal and water.

Moreover, the steam plowing engine is hampered by its excessive weight. It is not uncommon to find such engines whose working weights are 36,000 to 40,000 pounds. There are large areas of territory where such weights cannot be transported over fields without driving wheels of excessive width, which make it difficult for the engines to turn and maneuver.

It has been held that a gasoline traction engine of rugged and substantial construction would be the ideal plowing engine, because it would be free from the defects mentioned.

The gasoline traction engine shown in the illustration is rated at 22 actual traction horse-power. Hence, it is not as large as many steam plowing engines. Still it is large enough for most farmers. Compared with steam plowing engines of the same rating, it is much more substantially constructed, and yet weighs only 19,000 pounds. It uses cheap kerosene or gasoline for fuel, the supply tank holding enough to last for a day's run. The motor is air cooled, and hence dispenses with tank wagon and teams.

A traction engine uses up much of the power in merely moving itself over the ground. If the ground is soft and the cleats sink in deeply, it may use more than half its power for this purpose. The gasoline engine described is capable of continuously developing 40 horse-power, and on firm, level footing it will use up about 18 horse-power in propelling itself over the ground, leaving the available tractive effort of the engine about 22 horse-power. If the footing is quite soft, the available tractive power may be cut down to 18 horse-power. On the whole, the engine's tractive power is equal to that which can be continuously rendered by eighteen ordinary horses on comparatively level ground.

Everyone knows that there are two kinds of engine gang plows in common use, the moldboard and the disk. Each has some advantage not possessed by the other. In tough sod the moldboard plow is the only one that can be used for breaking. In sticky or "gumbo" soil the disk plow is the best for stubble plowing. In dry, hard soils, such as are found in most of the semi-arid regions, the disk plow is equally suitable for breaking or stubble plowing. It is generally admitted that in any soil suitable for a disk plow, a wider furrow can be cut with the same effort when applied to disk plows than to moldboard plows. In such soils, therefore, an engine with disk plows can turn more acres per day than if using mold-board plows. If each disk cuts a furrow only 8 or 10 inches wide and 5 or 6 inches deep, the ground will be plowed equally as well. On ground where there are more or less of hidden stones, the disk plow is the safest one to put behind an engine.

No doubt the condition of the soil and the depth of plowing also materially affect the draft of plows. It may take one-third more power to pull a plow through heavy soil that is almost dry, than if it were thoroughly moist. On heavy soils the draft increases out of all proportion to the depth of plowing.

Under average conditions, six 14-inch moldboard plows make a suitable load. Where disk plows are used, from eight to fourteen disks may be successfully operated, according to local conditions.

Regarding the amount of ground that can be plowed per day with a gasoline engine, the following calculation is said to be correct: In one mile there are 5,280 feet. A 14-inch plow bottom, turning 14 inches of soil, in cutting one mile will turn or plow 6,160 square feet. At a speed of two miles per hour the amount of ground turned by one 14-inch plow will be 12,320 square feet. As there are 43,560 square feet in one acre, the amount plowed by one plow (cutting 14 inches) in one hour will be 0.283 of an acre, or for a day of ten hours 2.83 acres. On this theory, four plows of the width mentioned in ten hours will plow about 12 acres; six plows, 17 acres; eight plows, 23 acres. It is a fact, however, that the ordinary day of the farmer is much longer than ten hours. Assuming that it is twelve hours, add to the above about twenty per cent.

The gasoline engine is speeded to run 2 1/3 miles per hour on hard ground. On soft ground there is some slippage of the traction wheels, and some time is lost in turning at the ends of lands, stops for oiling, adjusting plows, etc., so that the average rate of travel will generally be about 2 miles per hour, or 20 miles per day of ten hours.

In order to demonstrate clearly the superior economy of the gasoline plowing engine, an estimate of the daily operating expenses of the two types of engine plowing outfits has been prepared, both of the same size, and each presumably capable of plowing the same number of acres daily. The prices are based upon average North Dakota conditions, and 40 gallons, the maximum consumption of fuel for ten hours, has been used as a basis. The results are as follows:

Steam Traction Engine.

1 ton Hocking Valley coal	$7.50
Licensed engineer, who also steers	5.00
Fireman, who also handles plows	2.00
Water and coal hauling, 2 men 2 teams	8.00
Board of 4 men at 50 cents per day	2.00
Board of 4 horses at 25 cents per day	1.00
Lubricating oil	.50
Total daily operating expenses	$26.00

Kerosene or gasoline plowing outfit per ten hours is as follows:

40 gallons kerosene at 13 cents	$5.20
Engineer, who also steers	4.00
Plowman	2.00
Board of 2 men at 50 cents per day	1.00
Lubricating oil	.50
Total daily operating expenses	$12.70

It is maintained that the saving in favor of the internal combustion engine is $13.30 per day.

The Current Supplement.

The current SUPPLEMENT, No. 1695, opens with a short treatise on the boomerang and how to throw it. The boomerang is not discussed from a scientific point of view, but the personal experience of the writer is given—an experience which will undoubtedly be helpful to those who may take any interest in this strange weapon. William H. Booth presents the chief points of the difference between gas and steam engines. In the twentieth installment of his "Elements of Electrical Engineering," Prof. A. E. Watson discusses alternating-current measuring instruments and recording wattmeters. Madame Curie's excellent paper on "Modern Theories of Electricity and Matter" is concluded. "The Sixth Sense of Fishes" is the title of an article by N. Schiller-Tietz, in which the true purpose of the lateral organs of a fish is popularly discussed. Dr. Arthur Stieler reviews the various efforts which have been made to restore the Venus of Milo correctly. Illustrations of the various restorations accompany the text. "The Unity of Life" is the title of a thoughtful article in which respiration in plants and synthetic assimilation in animals are clearly discussed. John C. Sparks sets forth, with as little confusing technical terms and phrases as possible, the results and significance of a biological study of the effect of continued low temperatures on the germ life remaining in ice made from impure water. The excellent and thorough paper by J. Figg on "Automatic Cab-signaling Devices on Locomotives" is continued.

A French system for the employment of alternating instead of continuous currents in telegraphy has recently been devised. This system permits of the use of twelve instruments on a single wire.

AN INCANDESCENT LAMP WITHOUT A VACUUM.

(*Concluded from page 454.*)

filament does not further affect the lamp than to diminish its candle-power proportionately. Now helion is able to withstand higher temperatures and is found to possess greater radiating power under the passage of an electric current than the carbon filament, whose disintegration with use, as seen in the blackening of the bulb or complete failure due to volatilization with any increase of voltage above a critical point, are most familiar. The filaments of the helion lamp, on the other hand, can be worked with a satisfactory life when the filament is at a temperature of from 1,900 deg. C. to 2,000 deg. C. They have also successfully withstood a temperature of over 3,000 deg. C. at atmospheric pressure, according to measurements made with a Fèry pyrometer. In the evolution of the helion lamp, Messrs. Parker and Clark, the inventors, have gradually reduced the amount of carbon, so that their filaments to-day, so far as their surface is concerned, are entirely composed of helion. These filaments are made by taking ordinary cellulose carbon filaments and then "flashing" them in a special mixture of gases, so that the carbon is coated with many times its volume of helion. This surface may afterward become transformed into silicon oxide and silicon nitride by heating in an atmosphere of oxygen and nitrogen. Although the oxide may be volatilized at the highest temperatures when the filament is worked in a vacuum, the nitride is perfectly stable and withstands the heat, thus neutralizing the effect of the oxide. It is thought that this coating of oxide and nitride acts to protect the filament, and enables it to burn with high efficiency even in air. The comparatively large cross section obtained with such a filament gives to it great strength and rigidity, while at the same time it maintains a high resistance to the passage of the current. This of course makes for economy, since at a temperature of about 1,600 deg. C., the ordinary temperature of a carbon filament, the energy consumed is 3½ watts per candle as compared with 2½ watts for helion. Furthermore, to absorb 110 volts, a filament but two inches in length is required, which not only is much shorter than the metallic filaments, but even than those of carbon. A strong and durable filament capable of carrying ½ ampere is but 0.01 of an inch in diameter. It is this property of the filaments that makes it possible to use them in parallel, as has been stated, and the latest type of lamp is arranged for 40 candle-power with four separate filaments. This not only makes a most useful distribution of light, but affords a lamp that has a long life, not only in its original condition, but with diminished candle-power as the filaments burn out or break. In the four-filament lamps there is a central terminal from one of the leading-in wires, to which the filaments are connected on one side, while on the other they are connected with the corresponding leading-in wire. The efficiency of the helion lamp, realized in laboratory tests, ranges from 1½ to 2 watts per candle in the case of the 10-candle-power lamps to 1¼ and 1½ watts for the 20-candle-power lamps, and 1 watt for those of 40 candle-power. An experimental 1-watt lamp has been burnt over 700 hours, and the helion laboratory is now developing commercial methods and machinery for their manufacture.

The ability of these incandescent lamps to be made with bulbs containing air at atmospheric pressure has a particular application to battleships, where the discharge of the great guns is often sufficient to impair the incandescent lights throughout the ship. In fact, it has been stated that on certain of the Japanese battleships in the engagements of the Russo-Japanese war, the incandescent lamps were put out of action within the first five minutes of firing, and the necessary illumination had to be furnished by oil battle lanterns and the burning of oil-soaked waste. With filaments mounted in bulbs at atmospheric pressure, the lamps are much less likely to be broken by the sudden and violent pressure due to the discharge of the large guns, while the helion filaments, being much more rigid and stronger, can withstand the shock. The same conditions are to be found in land fortifications, where, even now, any possible failure of the incandescent lamps in the batteries is provided for by oil or arc lights, with suitable reflectors to illuminate the mechanism of the guns and mortars.

Lemoine, who induced Sir Julius Wernher of the De Beers Mining Company to give him $320,000 for an alleged process of making diamonds from carbon and sugar, and who was subsequently brought to book in the French courts by his victim, is a fugitive from justice. The French court gave him a certain time in which to substantiate his claim that he was really able to make diamonds. One day before the expiration of the stipulated time, Lemoine fled. A sealed envelope which Lemoine claimed contained the secret of his process, and which was intrusted to court, was opened and found to contain merely a worthless formula.

Correspondence.

Curiosities of Numbers.

To the Editor of the SCIENTIFIC AMERICAN:

I can add the following discovery of my own to your curiosities of numbers, although I am not mathematician enough to know whether it has been discovered before or what the explanation may be: Take any even number under 20, and place after it one-half that number. The number so written will be seven times the sum of the number and its half. Over 18 and under 200 it will be 67 times the number and its half, and over 198 and under 2,000 it is 667 times the number and its half. At 2,000 another 6 is put before the 667.

Lincoln, Mass., June 8, 1908. E. M. BROOKS.

Catalogue Indices.

To the Editor of the SCIENTIFIC AMERICAN:

You have always advocated a standard size for catalogues, which has been a good thing, but I find the way the catalogues are indexed is a nuisance. Some are indexed in the front and some in the back, and others are indexed in the center of the catalogue. When you are looking for a certain thing, you will be sure to turn to the wrong end. I find the best thing and a time-saver is to cut the top corners off the pages that the index is printed on. I cut the top corner of all the catalogues I have, and can find the index the instant I open the book. If there is any other way that is better, I would like to have you let me know. I think if you will advocate that there should be a standard way of indexing catalogues, it would be a good thing and a time-saver. JOHN B. HABERLE.

South Bend, Ind., June 11, 1908.

A Simple Weight-Lifting Device.

To the Editor of the SCIENTIFIC AMERICAN:

I want to give to you an ingenious device used by a canalboatman to raise a log weighing over two tons from the river surface to his boat.

First he floated the stick between his boat and the dock. At high tide he passed ropes around the stick and fastened it to the dock. So the log remained tied fast while the boat went down with the tide. At low tide he tied the log to the side of his boat, and then unfastened it from the dock. The rising tide brought up boat and stick together. At high tide he fastened the stick to the dock, and when the tide ebbed, he shoved his boat along side and under the stick and landed it on his boat.

By this means he accomplished what would have required a powerful derrick. And he alone, exerting no lifting power, loaded the stick on to the deck of his boat. The log was a Southern pine, 35 feet by 1 foot 6 inches by 1 foot 6 inches. I consider that his ingenuity was unique. FRANK B. MCLEAN.

New York, N. Y., June 1, 1908.

Automobiles Considered as a Cause of the Spreading of Mechanical Knowledge.

To the Editor of the SCIENTIFIC AMERICAN:

Whenever the anti-automobile crank voices his condemnation of the motor car as a public nuisance and a menace to human life and limb, some defender will be found to spring into the lists and do battle for the machine. The "counsel for the defense" will advance plenty of good reasons for the existence of the auto, and he will point out, with more or less show of reason, the innumerable benefits which the coming of the motor car has conferred upon the public at large. He will tell us how it has virtually opened the country in districts and territories where it was almost impenetrable. He will show us how the "auto rushes in where railways feared to tread," how road distances have been practically annihilated, and how real estate interests have been vastly improved since the motor car made it possible for a man to travel in his own private vehicle at a speed of forty or fifty miles an hour, from his country home to his city office, and *vice versa*.

But there is one strong point which, so far as the present writer is aware, has not yet been cited in favor of the automobile, and that is the compulsory mechanical education it has given, and is still giving, to thousands of people to whom mechanics, as a science, was formerly a sealed book.

The possession of an automobile has compelled, so to speak, the practical study of its machinery. Every owner has naturally felt that he ought to know every little detail about his purchase. The possession of a competent chauffeur did not relieve him from this obligation. To own a motor car means to own a desire to operate it. Half the joy of motoring consists in driving the machine one's self. The ability to do so competently means a delightful independence, an absolute freedom of thought and action. It gives one a feeling of self-reliance, of perfect confidence in one's power to guide the machine and regulate its speed at will with consummate safety.

It is no exaggeration to say that fully ninety per cent of present owners of automobiles knew little or nothing about mechanics before they purchased a machine. They may have been college graduates, and yet very deficient on mechanical matters. Law, literature, history, chemistry, medicine, art, music, finance, they may have claimed as special and favorite studies, and in many of these studies they may have taken high degrees, but they eschewed mechanics as being dry and uninteresting except to those bent upon a mechanical career.

It was not until these people purchased motor cars that they began to feel the lack of a mechanical education and the necessity for acquiring it. Unconsciously, as it were, but not unwillingly, they were driven to seek information about the engine and the individual parts of their machines. Had they not felt such knowledge to be imperative, they would not have wasted time on learning it, but with the possession of an automobile, the clear understanding of its working parts became a *sine qua non*, and the owner of the machine straightway set himself to the subject. He was confronted by a "condition and not a theory," and he felt that he *had* to give his mind to mechanical matters, whether he wanted to or not.

And the involuntary acquisition of mechanical knowledge was by no means irksome—even to the busy business man. In a short time it became a pleasure. Moreover, the very rudiments of mechanics seemed to open a whole vista of possible—easily reachable—mechanical knowledge. The laws of mechanics became additionally interesting because so easily understood. What had been a sealed book was now a wide open one. What had formerly seemed dull and uninteresting became attractive and pleasant. So that the automobile owner of necessity began to extend his fund of knowledge and information on general mechanical subjects, and many of the occult mysteries of a few years ago became self evident truths that were extremely simple in the light of later learning. The knowledge of parts of the machine, and their relation to each other, of the motive power and its ramifications, of measurements, pressures and weights, and of the various mechanical laws, became pleasant daily studies that embraced both theory and practice.

The effect of this is most significantly shown in the peculiar fact that very many improvements of parts in automobiles, during recent years, have been the invention of men who were not practical engineers, but rather amateur mechanics who had become such through being automobile owners. As religious converts are said to be more zealous than those born in the particular creed, so these graduates from "mechanical darkness" seem gifted with particular light to see where improvements are needed, and to furnish what is lacking in completeness.

Many automobile owners who have spent thousands of dollars on their machines are so satisfied that the money was well spent—because of the mechanical education that came with the machine—that they would not willingly accept a return of double the money expended to be obliged to go back to their original ignorance of mechanics.

Therefore, it is to the existence of the automobile to-day that we may safely ascribe a goodly percentage of the present knowledge of mechanics among laymen—a knowledge of vast importance to every individual; and this notable benefit to humanity should be prominently enrolled among the score or more of decided advantages which have been given to the world by the advent of the automobile.

New York, June 13, 1908. L. H. PERLMAN.

A Scheme for Reducing the Cost of Freight Transportation.

To the Editor of the SCIENTIFIC AMERICAN:

In every line, and in every mode of transportation, that forms an integral part in our complex modern civilization, to the man of serious thought, and to the analyzer of facts, there is overwhelming evidence of extravagance, waste, and inefficiency in our modern methods.

Transportation on the rail may be taken as a typical example, but approximately the same conditions will be found in all other systems and methods.

The ton-mile is the unit in which the traffic moved by a railroad system is measured. On the expense side of the railroad ledger, the number of tons moved, multiplied by the number of miles through which the traffic is moved, gives a product known as the ton-mile traffic of the road. Under normal conditions, the expense of moving a ton of traffic a mile is fairly a constant quantity, but the proportion of paying traffic to dead traffic varies from practically nothing to a maximum of say 70 per cent. An efficiency of 70 per cent is indeed highly satisfactory, in this class of service, especially when regarded from the standpoint of what is practically attainable; it however reminds the patron that *thirty cents* in every dollar paid for the transportation of freight is absorbed in moving the dead weight of equipment that is of necessity connected with the movement of the commodity. The example cited is one that is intended to show the highest degree of attainment in the movement of rail traffic.

Taking as a more common and a more frequently occurring example, we will find railroad companies moving a quantity of 5,000 pounds a distance of 200 miles at a rate of 13 cents per 100 pounds.

The modern freight car that is used for this class of traffic will weigh approximately 35,000 pounds, and as the contents weigh 5,000 pounds, the weight of the car with its load is 40,000 pounds, of which the paying traffic forms but 12.5 per cent. Regarded in another way, the cost to the consignee of moving 5,000 pounds of medium-class freight a distance of 200 miles is $6.50, of which $5.6875 is chargeable to the dead weight of equipment of the car alone (not including locomotives and tenders) and $0.8125 is the proportion that is properly chargeable to the commodity that is being moved. The charge in this case for moving the paying traffic being 1.30 cents per ton-mile, or figured on the total weight moved, 40,000 pounds, the railroad company receives but 0.1625 cent per ton for moving one ton of freight and equipment one mile.

If it were possible to wholly eliminate the weight of the equipment, the charge for moving a ton of medium-class traffic a distance of one mile would become 12.5 per cent of the above amount, or 0.0203125 cent. Such extravagance as this in the movement of traffic is almost beyond conception, and it goes without saying that it must work hardship to the patron and to the carrier as well.

The carriage of the stipulated minimum amount, in the merchandise class of freight, is authorized and practised by the leading railroads of the country, usually a direct car being loaded for a point 200 miles distant, when the weight of the contents of the car is equal to or greater than 5,000 pounds.

The jar, vibration, and concussion inseparably connected with the movement of heavy traffic, constitute an environment which limits the power of the structural engineer in problems of design, which have for their ultimate object the reduction of weight, for safety, which is paramount to everything else, cannot be guaranteed if the weight of the equipment is lowered sufficiently to give a small factor of safety.

Allowing that the weight of modern freight equipment cannot be safely reduced, what is the remedy that is to be applied for the suppression of an evil that necessitates the moving of 35,000 pounds of dead, non-paying traffic for the revenue which is derived from the carriage of 5,000 pounds of net traffic?

This is a serious problem, and it is worthy of patient thought and rigid investigation. It is a matter that may mean the difference between success and failure to a railroad corporation, and it should have the attention that its importance demands.

There is but one way of dealing with a matter of this kind, and that is to have all cars with light loads stopped at some point not more than 15 or 20 miles from the point of origin, and the contents of three or four cars consolidated, so as to bring the net tonnage of the car to an amount that will bear a respectable proportion to the gross weight of car and contents.

Such an arrangement of course would have the effect of causing a certain amount of delay to traffic; but as it will diminish the number of trains that are required to carry a given amount of traffic under more extravagant conditions, it greatly reduces operating expenses, leaving the receipts for traffic as great as before.

The expense of transferring 5,000-pound quantities of freight will vary greatly with the character of the freight that is handled, with such commodities as flour, sugar, salt, lime, etc., in barrels. Apart from the labor of shunting cars to freight platforms, a laborer receiving 15 cents per hour can make such a transfer in 15 minutes, at a cost of about 4 cents. Allowing that switching and other expenses cost 6 cents, making a total of 10 cents for the transfer of 5,000 pounds of freight, it is readily apparent that if the necessity of running a 35,000-pound modern car a distance of 175 miles can be obviated at a cost of 10 cents, it is a matter of extraordinary importance.

Four such cars handled and contents consolidated in one car, at each of ten stations, per day, would relieve 30 cars of being run a distance of 175 miles; this would practically amount to dropping out one freight train, the operating expense being decreased to that extent, and being increased only by an insignificant sum expended for making transfers.

Nor is this the sole advantage to be realized from the permanent workings of the above scheme. All over the country we hear that traffic is congested, when it is at all heavy. The double-track road needs a third track, the three-track road needs a fourth track, etc. If railroad presidents will give the car that is running a couple of hundred miles, with a content that is perhaps 10 per cent or 12 per cent of the gross amount of tonnage shown for engine rating, the attention that the matter deserves, if the need of an additional track to carry the road's traffic cannot be wholly dispensed with, at least it may be deferred to a time when such a contemplated change can be made without creating financial stringency or suppressing dividends.

A PRACTICAL RAILROAD MAN.

North Adams, Mass.

A CURIOUS ELECTRIC ELEVATOR.

BY J. D. VAN BRUSSEL.

A novel form of electric elevator has recently been installed at one of the new hotels at St. Moritz in Switzeriand.

The hotel is built on the hillside overlooking the lake at St. Moritz-Dorf, and the elevator is used for conveying passengers from the lower level to the main floor of the hotel. The car resembles that of an ordinary elevator, but is mounted so as to always hang vertically, swinging on an axis supported by trolleys running on elevated rails. As will be seen from the illustrations, the inclination of the rails is much steeper at the top than at the bottom. The rails are mounted on a light lattice steel structure, supported by steel towers.

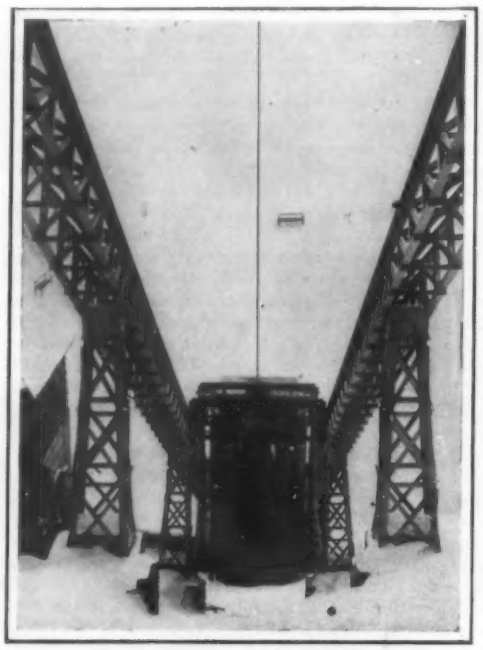
The working load of the car is 1,000 pounds, or six passengers, and the maximum speed of travel is 148 feet per minute. The total height of lift is about 92 feet, and the total length of travel, measured along the curved track, is about 132 feet. The apparatus is driven by a three-phase motor, supplied with current at 240 volts, 50 cycles.

The elevator is worked by a patented form of geared drum, for which a high efficiency is claimed, resulting in low current consumption. The gearing is of the double reduction type, with the motor and drum shafts in line, and is composed of cast-steel double helical wheels, with accurately machined teeth, inclosed in a cast-iron gear case, and running in oil. Care has been taken in the construction of the drum to make the grooves to accurately fit the diameter of the rope, in order to minimize wear. The ropes themselves are made of steel, with a factor of safety of ten.

The first pinion of the reduction gear is mounted on a shaft which is directly coupled to a 9-horse-power, three-phase motor by a flange coupling, which is arranged to serve as a brake drum. This brake is of the motor type, acting through a system of levels, and arranged to be released only when current is flowing through the motor in the usual manner. The whole machine is very compactly designed, and is mounted on a single cast-iron bedplate.

The trolley is fitted with a very effective form of safety catch. In the event of a breakage or slackening of one winding rope, two eccentric checks or cams are released, and grip the guides attached to the track, firmly locking the car. A speed-regulating apparatus is also provided, which actuates the same pair of gripping checks, whenever the speed of the car, from any reason, exceeds a certain predetermined value.

The control is effected by an automatic push button system, so that it is possible for the car to be used by passengers, without an attendant. The electrical control contacts are so interlocked that it is impossible for the elevator to be started before the doors are properly closed. Mechanical interlocking devices are also provided, so that the doors of the landings can only be opened when the car is opposite them. The car is automatically arrested at the end of its travel, but a pair of buffers are provided at the lower end as an additional safeguard. The car is similar to an ordinary lift car, with the exception of its suspension, but being for use out of doors, is covered with a galvanized roof. The counterweight is so proportioned, that the weight of half the working load is balanced.

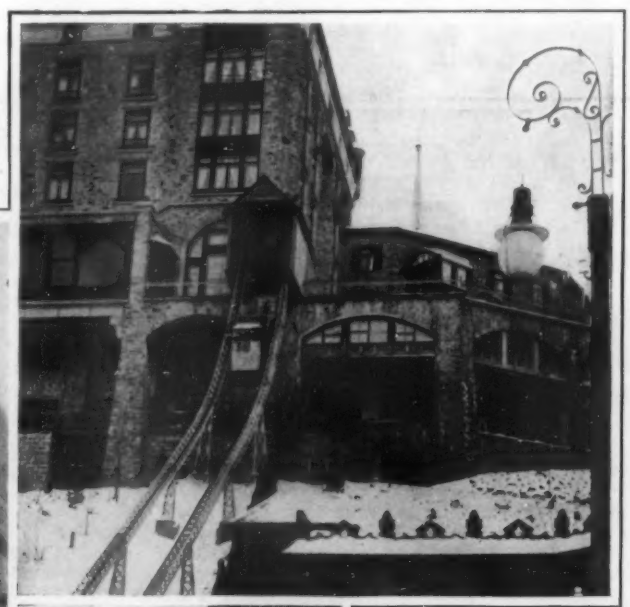


The Elevator Commencing Its Ascent.

Experimenting with Korn's Apparatus on a Commercial Scale.

The transmission of photographs at a distance is now beginning to reach a commercial scale, and the enterprising journal l'Illustration, of Paris, has taken the matter up, in order to make an exchange of photographs with London. In the latter city the offices of the Daily Mail are equipped with like apparatus, but at present these are transferred to the building which the journal occupies at the Franco-British Exposition. A visit to the offices of l'Illustration shows two of Dr. Korn's apparatus set for this purpose. One of these has been working for some months, while the new one has just been finished at the Carpentier establishment. These instruments are in charge of M. Chatenet, who has been transmitting photographs to London for some time past, for publication in the Daily Mail. The transmission requires about twelve minutes, and for this purpose a photographic film of large size, about eight by ten inches, is used. The receiving instrument reproduces the view on a small film of three by five inches. The result is good, but at present there is some difficulty on account of the use of the telephone cable across the channel. The transmission overland from Berlin to Paris is made more easily. M. Chatenet is now able to adjust the instruments better, as he has two of these at present, one of which can be used as a receiver.

Our Paris correspondent saw the transmission of a view between the two instruments. After developing the film the view appears as a negative formed of fine lines which give somewhat the effect of a half-tone. In next week's Scientific American a full description of the apparatus will appear. Dr. Korn's compensating selenium cell is used in this apparatus. The main selenium cell is connected to a second cell which also receives the light according to the value of the image. This action helps to overcome the inertia of the selenium, and makes the transmission much better, giving a clearer image. The matter of the compensating cell has been somewhat obscure up to the present, but we expect to give some information on this interesting question in an illustrated account of the apparatus in next week's Supplement. M. Chatenet states that Dr. Korn intends to make a trip to America.



A Front View of the Elevator and Track.

A Side View, Showing the Trolleys Which Carry the Car.

The Elevator Saves the Hotel Patrons Many a Hard Climb.

A CURIOUS ELECTRIC ELEVATOR.

Curious twists are observed in many tree trunks, and the inquiry just begun in Europe suggests the surprising conclusion that they are produced by the earth's rotation, like the twists of storms and the whirls seen in water. Van den Broeck, the Belgian geologist, points out that if conditions of growth were the cause the torsion should follow the sun's apparent path. In at least 990 out of 1,000 trees the reverse is true, and it may be that the twist is usually to the left in the northern hemisphere and to the right—or with the clock—in the southern hemisphere, like the turn of the cyclonic storms and water vortices. This difference is due to the earth's rotation. Jean Brunhes notes that it was shown some years ago that the winds due to the earth's motion blow steadily at a season when vegetation is active and sensitive, and a slight continuous bending and turning then would be likely to affect the tree permanently.—Bulletin No. 18, American Forestry Association.

A PHILIPPINE LEPER COLONY.

BY NEWTON FOREST RUSSELL.

Government estimates indicate that there are from 4,000 to 5,000 lepers in the Philippine Islands. To maintain them all in an isolated sanitarium would require an annual expenditure of about $400,000. If the segregation of the lepers would stamp out the disease, this would be a good investment. But in regard to the Philippines, medical evidence is by no means conclusive regarding the efficacy of segregation. A colony has, however, been opened, and a large number of lepers collected in it.

For the past several hundred years the care of lepers has received considerable attention in the Philippine Islands, but a careful review of the history of this disease shows that the work has been palliative rather than preventive. The good people who undertook this charitable work admitted to leper hospitals only those who were unable to earn their own livelihood or who had no one to provide for them. This of course left many lepers at large who had not become public charges, and in consequence there was ample opportunity for the disease to spread indefinitely. But now the isolation method is to be tried. The little island of Culion has been chosen for the colony, and the assembling of lepers at this place was begun some months ago. The construction of the Culion colony

The Town is Ideally Situated on a Cape Standing Well Out of the Sea.

The Church Surrounded by the Remains of an Old Spanish Fort.

The Hospital of the Colony Where the Worst Cases Are Cared For.

The Fathers in Charge.

Some of the Houses Are Actually Built Over the Water.

The More Active Members of the Colony Maintain a Good Band.

A PHILIPPINE LEPER COLONY.

has reached a point at which 800 lepers can be cared for. Of this number, about 500 have already been transported there. The remaining 300 vacancies will be filled from time to time as funds become available for the purpose.

The present plan of the government is to move all the lepers from those islands which are well isolated and at the same time have only comparatively few victims. In this way a large area can be freed of lepers at once; and the principal source of infection being removed, there should be few persons attacked in these sections in the future, and the few cases that do occur can be immediately removed. It is contemplated that only such persons shall be declared lepers as by microscopical examination are found to have leprosy bacilli in their tissues. One noteworthy fact was observed while the lepers were being collected, and that is only about one-half of those who were previously reported as lepers were, on careful examination, found to be so. If this same proportion should obtain in the islands which have not yet been inspected, the actual number of lepers would be very much smaller than was first estimated and the solution of the problem thus rendered easier. It was first thought that patients would be able to contribute something toward their support, but on closer observation it was ascertained that not much assistance in this connection could be expected. Nursing the worst cases, domestic duties, cooking, making clothes, keeping house, cleaning and taking care of the streets, making repairs to buildings, agriculture, etc., require the entire time of many of the colonists, leaving but few who could be employed otherwise. The question of cattle raising by the colony is now being considered. It would appear that this would be a light occupation in which the lepers might be successful. On account of the fact that cattle do not contract leprosy, that they could be slaughtered by non-leprous persons, and that the meat is necessarily cooked before eaten, it would seem that the public would not object to such meat being placed on the market. But whether this scheme will be attempted has not yet been decided upon.

The actual collection and transference of the patients who are already at Culion did not present as many difficulties as was first anticipated. On account of the fact that it was desirable, for administrative reasons, to reduce the number of places at which lepers were kept as soon as possible, it was decided to remove those lepers who had heretofore been maintained at the San Lazaro hospital in Cebu, and discontinue the latter institution. Accordingly the authorities with a number of medical inspectors arranged for the transfer of the victims by lighters from the hospital to coast guard cutters, by which they were transported to the island of Culion. The medical officers in charge of the colony had previously made all the necessary arrangements for receiving them. Four sisters of charity belonging to the Order of St. Vincent de Paul were already on duty at the hospital, to act as nurses for those who required more or less medical attention. Two priests of the Jesuit order, Father Valles and a companion, were also stationed at the colony, and aided in receiving the afflicted ones. The lepers on reaching the Culion colony were surprised and delighted with the new home which had been provided for them.

The present colony consists of a hundred and twenty-five *nipa* houses, each of which is large enough to accommodate from five to seven lepers. These houses are built on regular street lines, so that a regular town has resulted. The site of the town is located on a high point, which slopes in nearly every direction to the sea, the highest point being about 150 feet above the level of the sea, thus making the drainage system a most perfect one. A reservoir is located at a height of over 230 feet above the sea level and water from a spring is pumped into it by means of a gasoline water pump. From this reservoir flows pure fresh water to all parts of the colony by underground water pipes. A complete sewage system, which empties into the sea after passing through septic tanks, has been provided to carry away all unhealthy matter from the town.

The old town of Culion, in which a number of good houses yet remain, affords buildings for a *presidencia* or town hall and places of residence for the president and *consejales*. A stone church, built in Spanish times, has been put in good repair and is being used.

The patients are given all possible liberty, and are controlled by regulations which they themselves make. They are allowed to punish offenders against their own regulations in any manner they see fit. In order to give them a proper form of government, they are permitted to elect their own *presidente* and ten *consejales*. A police force composed of ten men has been organized, and it is their duty to see that the town is kept in good sanitary condition, as well as to make arrest of offenders against their own ordinances.

Ample quarters have been provided for the non-leprous residents of the colony. The director of the colony lives in a well-built house situated across an arm of the bay about two miles away. His abode is readily reached by means of a launch which is kept at the colony.

The treatment of leprosy with the X-ray at the Culion colony, which in 1906 gave so much promise, could not be continued this year on account of the lack of suitable apparatus, the apparatus on hand having become damaged, and there being no funds available for replacing it. The lepers who were reported a year ago as apparently cured have relapsed. One of them remained well, so far as it was possible to determine by frequent microscopical examinations, for nine months, and the other for seven months.

The Sisters of Charity in Charge of the Hospital.

A PHILIPPINE LEPER COLONY.

Decomposition of Cement Mortars in Sea Water.

In the decomposition of cement mortars in sea water we have to consider four different propositions, viz.: 1, the cement; 2, the sea water with all the substances in it dissolved; 3, living beings, as shells, plants, etc., affixing themselves upon the surface of the concrete, and lastly, 4, the atmosphere acting by means of its carbonic acid and water vapor. These different substances produce chemical, physical, and mechanical phenomena.

The chemical phenomena, by far the most important, include the hardening of the hydraulic binders, the decomposition of the so-formed components by sea water, and finally the combinations of all these products of decomposition with the elements of the cement or of the sea water. The physical phenomena are connected with the greater or less porosity of the mortars, and with the propensity of diffusion of the salts contained in the sea water; and further, there are produced in masonry exposed by the tides to the alternative influence of air and water, certain concentrations of salts upon certain places in the masonry, due to the evaporation of the water. The mechanical phenomena include the lifting of blocks of masonry by the waves, their disruption by the impact of these waves, and their wear through the friction of the sand.

But this is not all. None of these elementary phenomena can be produced without a certain reaction upon the other concomitant phenomena. The cracks, the wear by mechanical action of the sea, facilitate the physical diffusion of the salts, and this diffusion again resists the chemical action of these salts, by bringing them in contact with the lime. On the other hand, chemical action taking place in the masonry causes cracks, facilitating the penetration of the salts and the disruption of the blocks of concrete under the action of the impact of the sea, etc.

All the hydraulic binders, without any exception, are soluble in sea water, with of course different degrees of quickness. This decomposition or solubility is slower:

1. The smaller the amount of alumina in the cement. Relatively small amounts of alumina, say higher than 3 per cent, are sufficient to show the deleterious effects of this substance.

2. The higher the index, at least in the case of ordinary Portland cement. It is true that under ordinary conditions this increase of the index, and stimulating as it does the pulverization at low temperature, quickly lessens in an unacceptable way the mechanical resistance.

3. Quick-setting cements with a large amount of sulphate of lime and with a high index have given very satisfactory results. The lessening of the resistance with the increase of the index is smaller than in the case of Portland cement, because the presence of sulphate of lime opposes the pulverization at low temperature.

4. The addition of puzzolans, especially burnt clay, and without doubt also of high degree trasses, gives to all hydraulic products a greater chemical resistance. By firmly binding the clay into insoluble combinations, these resist the elimination of the clay by diffusion, as also the correlative increase of the porosity of the mortar.

5. The compactness of mortars, resulting from the decrease of the quantity of tempering water, or from the increase of the active elements, seems to be the most essential factor in the conservation of the mortars in sea water. It is, therefore, certain that the addition of puzzolans, independently from all chemical action, will be very useful by increasing the compactness of the mortars.

The truth of this assertion has been proved by tests made by Prof. Nasini and Antony of Italy. They replaced the clay entering into the composition of cement by puzzolanic materials, so as to reduce to a minimum the amount of alumina, to whose presence is due the destructive action of the sea water.

These materials are added either at the time of the loading of the rotary kilns, or still better, to the red-hot clinkers coming out of them. If continuous kilns are used, this addition is made by sprinkling the still red-hot clinkers with pulverized puzzolanic materials. The grinding and pulverizing of the so-obtained products is then performed as usual.—Synopsis of papers by H. Le Chatelier in Annales des Ponts et Chaussées and Prof. Nasini in Tecnico Moderno.

New Researches in Fermentation.

Buchner's discovery and isolation of the enzyme which causes alcoholic fermentation decided a controversy that had continued during a decade and proved that fermentation is a chemical process. In addition to this enzyme, which is a yellow liquid to which Buchner gave the name zymase, he discovered in the expressed juice of yeast two other enzymes, which he called katalase and endotryptase. The last named substance exerts an injurious action on fermentation and is the cause of the decrease in strength which yeast juice exhibits after prolonged exposure to the air.

The chief final products of fermentation, alcohol and carbonic acid, have long been known, but the determination of the intermediate and by products is not a simple matter. Fermentation caused by expressed yeast juice produces a larger quantity of glycerine than is obtained from fermentation with living yeast, probably because some of the glycerine produced in natural fermentation is consumed as food by the yeast cells. On the other hand, yeast juice produces scarcely a trace of succinic acid and fusel oil, which are always present in natural fermentation.

Lactic acid may be regarded as an intermediate product, in the formation of alcohol from sugar. Hence the process of fermentation must comprise at least two stages, and zymase must be composed of two enzymes, of which one converts sugar into lactic acid and the other reduces lactic acid to alcohol. Harden and Young have discovered that the fermentation of sugar with yeast juice is greatly accelerated by the addition of boiled yeast juice, and that the same addition restores to inert juice its original power of inducing fermentation.

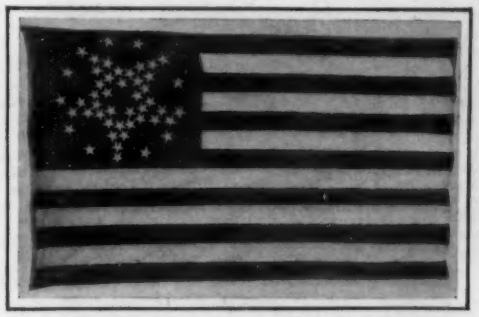
Home-made Graham Bread.—The following directions for making Graham bread at home are given by J. Dormeier in the Pharmazeutische Zeitung: Take 2 pounds of bruised wheat, 1 pint of milk, half that quantity of water or buttermilk and a teaspoonful of salt and knead the whole thoroughly. Then place the dough in a long metal mold previously smeared with butter and powdered with flour, make the surface firm and smooth with a tablespoon dipped in hot water, cover it up and allow it to stand near a warm range for half an hour, not much longer, or the bread may become crumbly. Then put the mold with the dough in a well-heated baking oven, turn it in half an hour, and bake till the bread is brown all over. To give a shining surface to the bread, pass a brush dipped in water over it just before it is done and let it remain another minute in the oven.

NEW GROUPING OF STARS IN THE UNITED STATES FLAG.

Some time ago a representative of Congress (Mr. Shaforth) proposed a new arrangement of the white stars in the blue field of the United States flag, which he considered would be more symmetrical and emblematic of the formation of the Union than the present straight-line method. A bill of Congress on this subject was introduced by him. He describes the object as follows:

"The original thirteen States are formed in the shape of a large circle of thirteen stars. The balance of the States are represented within this circle by a series of smaller stars, arranged in the shape of a five-pointed star. Each star is intended to represent a distinct State. The star forming the uppermost point of the inside star will represent the first State admitted to the Union after the original thirteen States; other stars follow below in sequence according to the order in which the States were admitted."

The illustration is made from a photograph of a flag, recently prepared by a lady in Brooklyn, which was unfurled for the first time in commemoration of the fiftieth anniversary of her wedding. It contains forty-seven stars, one more than the number of States actually admitted, it being expected at the time it was made that Arizona and New Mexico might be admitted as a separate State. The forty-fifth State admitted was Utah, in 1896, and the forty-sixth State, Oklahoma, in 1906, to begin its statehood in July, 1908.



NEW ARRANGEMENT OF STARS IN THE UNITED STATES FLAG.

A CLEVER SUBSTITUTE FOR A DRYDOCK.

BY H. M. MASDELL.

Shipping men on the Great Lakes are displaying considerable interest in the experiment which the Niagara Navigation Company have recently been conducting in connection with their new steamer "Cayuga," the latest addition to their fleet, operating on the Toronto-Niagara Falls-Buffalo route. The "Cayuga" is a twin-screw steamer with a speed of 23 miles per hour, which went into commission last year for the first time.

There is only one drydock on Lake Ontario large enough to accommodate the "Cayuga," and it is at Kingston, 160 miles from the steamer's route. Any slight mishap to a propeller blade might necessitate going to drydock; and the withdrawal of so large a ship as the "Cayuga" from service during the profitable season, with the prospect of delay in the event of another steamer being in drydock at the time, not to mention the expense involved, induced the company to seek other means to meet the situation.

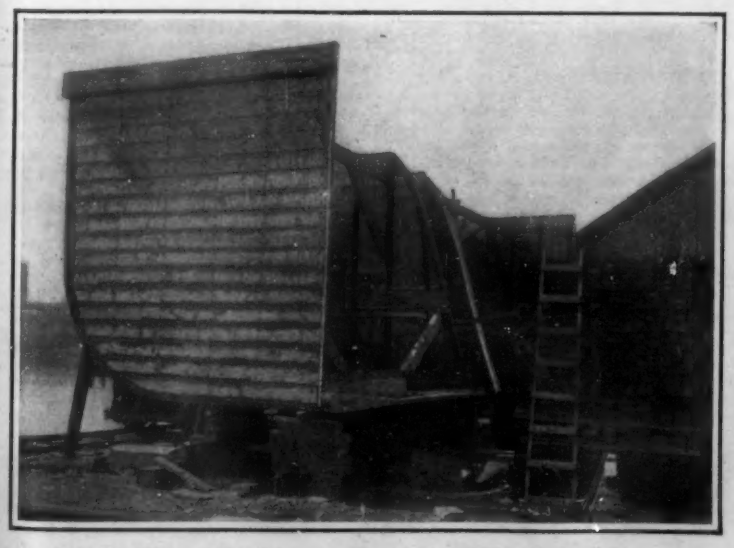
Most shipping men are aware that caissons have been employed in effecting repairs under water to the propellers or shaft bearings of single-screw steamers, but we have never heard of this device being applied to ships propelled by twin screws. Working from drawings of the ship and measurements of the hull, taken from the ice in the early spring, two three-sided caissons, one for the port side and the other for the starboard, were built of 2½-inch pine planking. The framing was 3 x 3 x ⅝-inch steel angles, set at 2-foot centers and bolted below to a 4 x 12-inch oak keelson. The planking was fastened to the steel frames with ½-inch bolts. Below, the angles were allowed to project enough to pass across the keel of the ship and the planking was carried over this, thus forming a support which pressed up against the keel, and helped to keep the caisson down in place when the water had been pumped out. Additional strength was provided to withstand the pressure by running a 6 x 13-inch top strake of oak around the outer and upper edge of the caisson. Some three feet below this was fastened a 3 x 8-inch oak wale, bolted through to an inner strake with ⅝-inch bolts. Diagonal framing of 3 x 8-inch oak was also used, and a 4 x 12-inch fore-and-aft strongback tied the two inboard ends at the top. To admit of the caisson passing the shaft (the chief problem to be overcome) two doors on hinges were provided at the forward end, the lower of which opened downward and the top one upward. These doors are left open until the caisson is attached to the side of the ship, when they are closed by means of chain attachments. The diameter of the "Cayuga's" shaft is 10 inches, and the doors are so constructed that a slight clearance is allowed when both are closed, leakage being prevented by a three-ply ⅛-inch rubber gasket. Underneath the keel a water-tight fit is secured by using a packing consisting of 1-inch rubber hose. The "Cayuga" draws 10 feet 9 inches, and the caissons are 12 feet deep, so that they rise about 15 inches above the surface when attached. They have sufficient buoyancy to float, and when placed in an upright position, their draft of water equals that of the ship.

View Looking Down Into the Caisson, Showing Propeller Blade Being Detached.

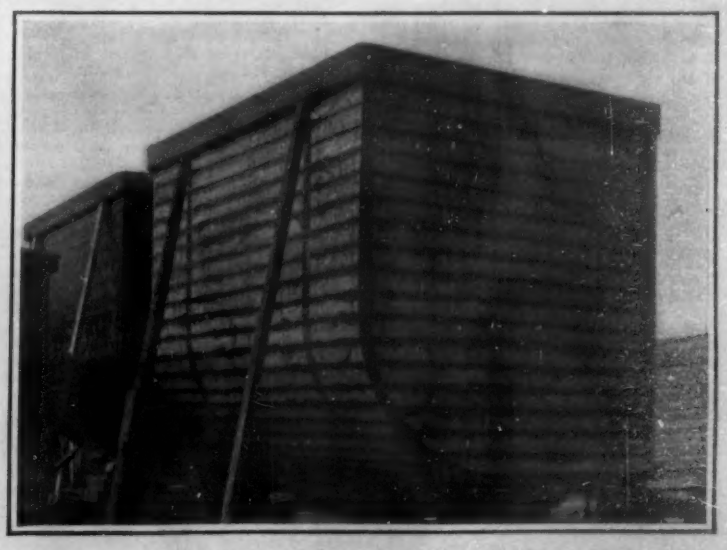
Two ⅝-inch chains are attached to the angles which project beneath the steamer's keel, and the caisson is drawn into place by means of these, which are passed under the hull of the steamer and drawn taut from the opposite side with turnbuckles. The caissons are 16 feet long and 11 feet wide, being of sufficient dimensions to inclose the strut supporting the stern bearings and also the propellers. Ample clearance is afforded for turning the propellers when the caissons are in position, and also for carrying on the necessary work.

While pumping operations are going on, the caissons are kept steady with two diagonally-placed turnbuckles, each being of 1¼-inch iron, about 8 feet long, and fastened to eyebolts underneath the quarter of the ship. Three smaller turnbuckles are also arranged vertically along the top strake. The water is pumped out with a flushometer steam pump having a capacity of 12,000 gallons per hour. The pump is placed on the deck of the steamer, and the water discharged through a 5-inch pipe. When the caissons have been emptied, any slight leaks are more than offset by an auxiliary 2-inch siphon. To resist the upward pressure of the water, the caissons are held down by shores from the overhanging guards of the steamer.

The caissons were adjusted without difficulty, and once in place it was found that operations could be carried on inside quite comfortably. The device was found entirely satisfactory in practice, and will in future be employed in connection with any repairs to the propeller or stern bearings of the "Cayuga."



Exterior View of the Caissons. The Cassions Were Built of Pine Planking Bolted to Steel Frames.



These Caissons Were Placed Against Ship's Side. The Water Was Pumped Out, and Repairs to Propellers Made.

CAISSONS BUILT TO TAKE THE PLACE OF A DRYDOCK.

Soil Fatigue Caused by Fodder Plants.

The continued cultivation of such fodder plants as clover and lucerne on the same land is accompanied by a progressive decrease in the crop. This phenomenon has been called "soil fatigue," and various explanations of it have been given. The recent experiments of Pouget and Chouchak prove that soil fatigue is not caused by the exhaustion of the supply of plant food alone, but that clover and lucerne, like hops, excrete poisonous substances which accumulate in the soil and finally arrest the growth of the crop. Rich soil that had never borne a crop of lucerne produced a crop smaller than the normal on the addition of the dried aqueous extract of the soil of a lucerne field, but no such decrease in crop was observed when the extract was roasted before it was mixed with the soil. On the other hand, the application of an extract of soil that had never borne lucerne and had been abandoned to spontaneous vegetation for two years caused an increase in the crop of lucerne. These results indicate that lucerne excretes substances which are detrimental to its own growth. The action of these substances is analogous to that of toxins. Alcoholic extracts of the soil of a lucerne field exerted no injurious effect upon the growth of lucerne and soil that had been sterilized by heat yielded larger crops than unsterilized soil.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT. — S. GREENES, Poughkeepsie, N. Y. The garment is provided with openings so secured by fastenings as to render its size, to some extent, adjustable at will, and so arranged that the garment is reversible, presenting to the eye a constructional difference in appearance when viewed upon one of its sides, as compared with the view presented from the other side.

TENSION DEVICE FOR SHOE-LACES.—R. DOROTHY, Conconully, Wash. In this case the invention refers to boots and shoes, and the object is to produce a device which is adapted to enable the tension of the shoe laces to be relaxed when desired, so as to enable the shoe to be removed without untying the laces.

OVERSHOE-FASTENER.—J. HOPSON, Ogden, Utah. The object of this invention is to provide a device which will securely hold an overshoe in place upon a shoe against accidental removal of the overshoe. The fastener is secured to the rear position of the overshoe in combination with a part attached to the rear portion of the shoe, which may be easily and expeditiously fastened in place and removed.

DEVICE FOR IDENTIFYING GARMENTS AND HEADWEAR.—I. S. ROSS, Woodward, Okla. This device is adapted for readily and conspicuously marking temporarily a hat, coat, or umbrella that may be hung or placed exposed closely to like articles belonging to other persons in places for public assemblies and thus facilitate identification of one's wear or property. It instantly indicates to parties that they have selected a wrong article by mistake.

Electrical Devices.

RUHMKORFF COIL.—J. MCINTYRE, Jersey City, N. J. The coil is arranged to allow continuous running of the apparatus without requiring retruing of the contact platinum-portions, and insures a proper readjustment and contact between the said contact platinum-portions, without danger of quickly burning their respective faces. The invention relates to Ruhmkorff coils for use in electro-magnetic apparatus, such as in the Letters Patent of the U. S., formerly granted to Mr. McIntyre.

TROLLEY.—E. D. PERRSTONE, Chicago, Ill. The trolley is so constructed that the trolley wheels cannot easily become disengaged by accident, from the trolley wire, and maintains a constant and effective electrical contact with the trolley wire. The wheels are automatically guided from one trolley wire to a branch wire when the car passes from one track to a branch track, and in case it is freed from the trolley wire, cannot be injured by accidental engagement with a cross or supporting wire of the trolley wire.

Of Interest to Farmers.

INCUBATOR.—G. H. LEE, Omaha, Neb. The invention pertains to incubators, and especially to means for ventilating the same. It is especially applicable to the type formerly patented by Mr. Lee. The construction insures a perfect air-tight joint between the egg-chamber and treating chamber, and provides improved means for ventilating the egg-chamber.

CULTIVATOR-HOE.—O. G. BANTLEY, Lebanon, Mo. In the present patent the invention has reference to improved cultivator hoes or shovels, and the object of the inventor is the production of a hoe or shovel which is so constructed that it may be readily attached to hoe bars of different construction.

PEANUT-STEMMER. — J. T. BENTHALL, Ahoskie, N. C. The vines are fed into the hopper by any suitable means. The vibration of the hopper feeds them toward the stemming devices by which the stems are engaged and drawn between the slats which are far enough apart to permit the passage of the stems but too close to permit that of the nuts which are stripped from the stems and pass outwardly at the rear of the hopper, the vines falling from the stemming devices through the lower frame.

APPARATUS FOR EXTRACTING HONEY. —L. W. AVANT, Atascosa, Tex. In this case the invention is in the nature of a novel apparatus for use in extracting honey from bee hives without opening the hive and without materially disturbing the bees and also without robbing the hive of the wax of which the cells are made.

TURN-TABLE FOR INCUBATORS.—C. V. SNEDEKER and J. DEW. WARE, Savannah, Ga. One purpose here is to provide a turn table, or an attachment upon which a tray of eggs can be slid directly from the incubator upon a turn table and turned thereby end for end to be again returned to the incubator thereby effecting a shifting of the eggs in a rapid and convenient manner and without danger of agitating the contents of the shell.

DETACHABLE POTATO AND VEGETABLE ELEVATOR.—A. W. WOLF, Hampton, Iowa. A purpose of the inventor is to provide a form of elevator for use in connection with any form of potato digger, but particularly what is known as the "Dowden," and to so construct the device that vegetables are taken directly from the digger and elevated in a manner to deliver them into a conveyance drawn or propelled beside the digger and kept beneath the upper end of the elevator.

Of General Interest.

EYE-SHADE.—B. F. WADE, Palmetto, and T. F. MONTGOMERY, Tampa, Fla. The shade is designed especially to protect the eyes against the glare of water, sand, and other reflecting surfaces. In practice the shades may be made of aluminium and printed or colored in any suitable dead or flat color, the bows or temples being similar to those ordinarily used on spectacles.

DENTAL CEMENT AND PROCESS FOR MANUFACTURING THE SAME.—F. L. GRIER and G. L. GRIER, Milford, Del. The invention consists in mixing certain solutions and the translucent cement obtained is extremely hard, of dense texture, and pearl-like luster, is susceptible of high polish which is lasting and more perceptible under the influence of moisture, rendering it of particular beauty.

ADVERTISING DEVICE.—W. FRASER, Escanaba, Mich. One purpose of the improvement is to provide a device in the form of an amusing toy wheel or disk, and means whereby through the medium of an attached cord the wheel or disk can unfailingly be made to travel upon its edge with greater or less velocity to attract attention to and conspicuously display advertisements produced thereon.

BOTTLE-NECK AND ATTACHMENT THEREFOR.—D. S. HAYNES, Evansville, Ind. In this patent the purpose of the inventor is to provide a novel feature of construction for the neck of a bottle, and a novel insertible attachment therefor, which when in place will prevent the refilling of the bottle after its contents have been removed.

ROAD-SCRAPER.—C. H. SNYDER, Percival, Iowa. In operation the drag may be set to draw the dirt from both sides of the road, and to fill up and smooth all ruts in both wagon tracks, and when the sections are set with the blades straight across, the drag may be operated to pulverize and smooth the road. It is especially designed for use as a four-horse drag.

CRATE.—J. HETTRICH, Grand Island, Neb. This invention is an improvement in crates, and the crate comprises a collapsible frame lined with a sheet of fabric material, the ends of the sheet projecting beyond the ends of the crate, and adapted to be tied to form an inclosure, the free edges of the sheet overlapping, thus forming a bag.

ORE-SCREEN.—F. FRANZ, Burke, Idaho. This apparatus effects in a cheap and expeditious manner the separation of the finer portions of pulverized ore and other material from the coarser and less valuable portions and a worn out or defective screen may be easily replaced by a new one, while the frames to which the screens are attached may be readily detached, by removing the wedges from the chains.

ELLIPSOGRAPH. — J. T. KELLEY, West Rush, N. Y. A special purpose of the present invention is to provide means whereby a compass of the ordinary form of construction may be readily attached to and detached from the inclined rod and held in sliding engagement thereto. A further object is to so construct the attaching means that the compass leg and rod are held more securely in parallelism. It relates to improvements in connection with the ellipsograph of Mr. Kelley's former patent.

DRUM.—A. D. CONVERSE, Winchendon, Mass. One object of the inventor is to provide metal hoops for drums, which hoops are constructed of thin metal in such manner as to give the hoops the appearance of thickness, or of being solid, the hoops being adapted for use in connection with either metal, paper, or skin heads.

STALL FOR ANIMALS.—W. M. UNDERHILL, Oconto, Wis. The purposes here are to render the cow stall more convenient, afford better control of the animal while stalled, furnish more effective means for receiving and holding liquid or solid animal excrement, and furthermore facilitate the transfer of such into a gutter at the rear end of the stall, whether the animal is standing or lying down, whereby the floor is kept clean and soiling of hide is prevented. It is an improvement on the former patents granted to Mr. Underhill.

MAIL-BOX.—J. A. SIEGFRIED, Monmouth, Ill. This mail box is adapted for the automatic display of a sign that indicates if mail has been deposited in the box. It is particularly well adapted for use on rural mail routes, as it affords means for the infallible indication that mail has been placed in the box by the carrier, and also will exhibit a signal for notifying the carrier that mail has been placed in the box for collection by him.

CHECK-BOOK.—F. C. RHODES, New York, N. Y. The book is such as used by bank depositors in drawing against their accounts. In the use of such books as ordinarily constructed, it is necessary to add the column of drafts and deposits entered upon each stub sheet or page in order to carry the balances forward through the book. It obviates constantly adding the itemized drafts or deposits in carrying the balance forward through the book.

SMOKE-PURIFIER AND FUME-ARRESTER. —T. E. LAMBERT, Butte, Mont. The improvement refers to purifiers and arresters such as are used in connection with furnaces, gas plants, chemical works, and similar industrial works. The object is to produce an apparatus which will operate to remove the impurities from smoke and gases, so that they will not be poisonous or obnoxious to life.

PLAYER-PIANO.—G. HOCHMAN, New York, N. Y. The invention relates to pianos in which the keys are connected with electrical or pneumatic actuating devices. It provides improvements in pianos, whereby actuating devices can be readily disconnected from the keys to allow convenient removal of the entire keyboard and keys when desiring to repair the action or other purposes.

PAVING-BLOCK.—H. A. KRATZER, Clearfield, Pa. The object of this invention is to provide a paving block of vitrified material, and arranged to insure the formation of a hard road surface, not liable to break or chip at the joints of the paving blocks and to prevent shifting or spreading of the blocks even when laid on the road-bed without curbs.

CASTING DEVICE.—P. SCHWICKART, New York, N. Y. The aim in this instance is to provide a device for use on the flask or mold, and arranged to insure proper filling of the mold with the molten metal, and without danger of slag, scum, or other like impurities passing with the molten metal into the mold, thus insuring the formation of very fine homogeneous castings.

BINDER FOR LOOSE-LEAF BOOKS.—C. G. VAN BUREN, Provo, Utah. The device is specially well adapted for clamping the loose leaves of a note book, sketches, clippings, or any loose manuscript in leaf form, between suitable cover boards, in a manner which enables a smaller or larger number of leaves to be quickly and securely bound between the cover boards, and also permits the convenient removal of one or more leaves from the book, as may be desired.

Hardware.

COMBINED SNAP-HOOK AND BUCKLE.—J. W. HUTCHISON, New Matamoras, Ohio. The purpose of this inventor is to provide details of construction for a snap hook and a buckle formed integral therewith, and the combination therewith of an attachable buckle, disposing the buckles at each end of the hook for the connection of strap ends in sequence by means of the buckles.

HINGE.—H. P. SQUIRES, Passadumkeag, and E. A. BUCK, West Enfield, Maine. The aim of the improvement is to provide a construction for a hinge and adapts it for secure connection upon the jamb of a door casement or fence post, and dispense with screws for such connection; and enable the quick detachment of the door and its hinges from the casement without the use of tools when this is desired.

TOOL FOR HOLDING SHEETS OF ABRADING AND POLISHING MATERIAL. —M. O. RANDALL and A. J. CAMPBELL, Los Angeles, Cal. The invention is an improvement in that class of devices adapted for carrying or holding sandpaper and other abrading or polishing sheets. The sand-paper is preferably extended over the small end of the body of the tool, making it adapted for use by dentists, jewelers, and others, for polishing articles.

HINGE.—E. WITMAN, JR., Wernersville Pa. In this patent the invention is an improved hinge, more especially designed for window shutters, and being adapted when applied thereto to positively lock the shutter when opened, whereby it will be impossible for the shutter to be rattled by strong winds.

PACKING-TOOL.—C. GROHMAN, Carteret, N. J. More particularly the invention relates to means for applying a packing formed of a cord and for firmly and securely forcing the packing into place with a single blow of the tool. The object is to provide means for holding the end of the cord while it is being wound around the mandrel, and to provide improved means for driving the packing into place.

AX-HELVE.—H. HALL, South Thomaston, Maine. The improvement is in helves for axes and other tools, and the object is to provide a fastening which will secure the ax or other tool firmly in place at a plurality of angles on the helve, the fastening being constructed so that it will offer the least possible resistance to the passage of the ax through the wood.

CARPET-FASTENER.—A. B. HEYDRICH, Allerton, Iowa. In using this device the holders are secured to the floor at suitable intervals. The carpet is then drawn up toward the wall, and a portion of the carpet somewhat back from the edge is engaged with the points, after which an arm is drawn toward the wall until it contacts with the floor, this movement moving the points upwardly through the carpet and downwardly through the same so that only a small portion of the points appear on the surface of the carpet.

Heating and Lighting.

ALCOHOL-STOVE.—A. RICHTER, Arlington, N. J. Mr. Richter's invention relates to stoves, his more particular object being the production of a type of stove suitable for cooking by means of alcohol. It further relates to certain improvements made for the purpose of promoting the safety of the stove, and to render its various parts more readily accessible.

BUILDING-LIGHT.—P. SCHWICKART, New York, N. Y. The light is for use on vaults, skylights, floors, etc., and is completely water and moisture-proof, and is arranged to distribute the rays of light uniformly over a large space, and permits of conveniently placing the lights in position in the supporting frame and securely locking the same therein.

Household Utilities.

POLE-SUPPORTER.—REBECCA HICKEY, New York, N. Y. In this patent the invention has reference to pole supporters, the more particular object being to provide a support for a plurality of poles, in such manner that the poles may be removed independently of each other, and further to enable one of the poles to be turned to different angles relatively to each other. It further relates to means for enabling one or more poles to be supported from a picture molding or the like, without the necessity for defacing the walls of the apartment.

EXTENSION-TABLE.—A. P. TAGLIAFERRI, New York, N. Y. Tables of circular form are of the type intended to be improved by this invention, and they may be extended without substantially varying their shape. The invention also provides for the convenient storage of the table leaves when the same are not in use. A table having the advantages of the present construction requires a pedestal setting; further, the storage for the leaves is done without any possibility of their sliding in the compartment, and the process of expansion and contraction is accomplished with ease and celerity.

FLY-PAPER HOLDER.—R. E. FEE, Marion, Ind. The object of the invention is to provide a device of comparatively simple construction, which may be adjusted to hold sheets of fly paper of varying size and retain them under slight tension, also to provide for the suspending of the holder when not in use. The paper cannot curl up, and may be moved without soiling the hands.

Machines and Mechanical Devices.

COUNTER.—R. W. VARDEMAN and C. B. VARDEMAN, Marshall, Mo. The invention pertains generally to that class of machines called counters or registers and particularly to cyclometers. It is also applicable to machines known as logometers, or word counters, which are adapted for the purpose of counting words automatically as they may be written on the typewriter, or on a type setting machine.

PIPE-MOLDING MACHINE.—W. A. MURRAY and ELLA M. M. BABBITT, Sanford, Fla. This is a simple, practical, and easily constructed machine for molding pipes from hydraulic cement and especially small drain tile of 3-inch diameter by 12 inches long and the invention consists in the construction and arrangement of such machine and its parts, whereby such pipe may be rapidly and cheaply formed.

SEWING-MACHINE TABLE.—E. C. SAETTLER, Giddings, Tex. In this instance the invention has for its purpose the provision of an attachment for extending the sewing top of the machine, particularly in such machines wherein the sewing top is elevated above the machine top proper, and affording little, if any, support to the work.

FLYING-MACHINE.—F. R. SWEENY, Anderson, S. C. The object of the invention is to produce means of propulsion, including means for balancing or maintaining the equilibrium of the machine. Gyroscopes keep it in horizontal position. They rotate oppositely so that when running at low speed and lose part of the tendency to remain horizontal, they counteract each other in action and thus a perfect balance of the machine is obtained.

MACHINE-FRAME. — E. F. HEDDERICH, Flora, Ind. In the present patent the purpose of the improvement is the provision of a machine frame of novel construction, which is specially well adapted for the reception and support of operative mechanism employed for rotating the holder of a hand cream separator device.

WOODWORKING MACHINE.—W. B. WOODRUFF, Cadiz, Ky. Mr. Woodruff's invention is an improvement in woodworking machines, and the object is to provide a machine capable of cutting a stick of timber with parallel sides, inclined sides, or in irregular form following a pattern. It may be operated continuously to plane pieces of timber having two inclined sides, it only being necessary to reverse the alternate pieces.

CLEANING-MACHINE. — D. E. PRESTON, Chicago, Ill. The aim of this invention is to provide a machine to readily remove dirt, hairs, and other undesirable parts or extraneous matter from the article under treatment, and without the use of knives or similar cutting devices and without danger of injuring the article by tearing or cutting the same, and also without requiring the employment of skilled labor.

Prime Movers and Their Accessories.

CARBURETER.—O. E. BYRON, San Francisco, Cal. The more particular intention in this case is to maintain an even vacuum under all working conditions. To this end Mr. Byron so constructs the carbureter as to admit varying quantities of air to the mixing chamber, the admission being controlled ultimately by the condition of the vacuum within the mixing chamber.

CHARGE-SUPPLYING MEANS FOR INTERNAL-COMBUSTION ENGINES.—P. MACA. MACKASKIE, Central, Nev. More particularly the invention relates to means for forcing the air or liquid or gaseous fuel either separately or together under a state of compression into the cylinder and at equal pressures. The pres-

ent application is a division of a patent for a rotary engine formerly granted to Mr. MacKaskie.

ROTARY MOTOR.—C. G. MAYER, Hazleton, Pa. The invention refers to improvements in rotary motors, the object being to provide a motor of simple construction that may be operated with an economical use of steam or other motive agent. The motive agent passes practically in a zigzag course through a chamber, filling the space between the blades and impinging against annular flanges.

OSCILLATING WIND-MOTOR. — D. D. MCINTYRE, Bucklin, Kan. This invention is in the nature of a wind motor of that type in which an oscillating frame is arranged upon a horizontal axis and is provided with blades that are alternately turned flatwise and edgewise to the wind and the force of the wind is applied directly to produce the oscillations of the frame.

Railways and Their Accessories.

AUTOMATIC DUMPING-CAR.—J. W. REED, Berwind, Col. The car is more especially designed for hauling coal, but can be used with advantage for hauling ore, dirt, or other material. One of the objects is to provide a car which can be dumped and closed up automatically, thereby dispensing with the labor, time, and expense usually entailed when these operations are performed by hand.

RAILWAY-TIE.—J. H. HOUCK, Salisbury, N. C. The intention in this case is to provide a tie of the composite type, that will be comparatively light to handle, yet will be strong and serviceable. It is readily handled, as the several sections or members may be carried to the place of use and then the sections of the tie assembled and secured together.

DRAW-BAR OF CAR-COUPLINGS. — L. BOIRAULT, 8 Rue Emile Gilbert, Paris, France. The purpose of the improvements is to provide means whereby the spring of the yielding buffering device operates by compression to resist both the impingements of the cars and the pulling action exercised by the train, and to provide means whereby the drawbar is yieldingly held in the axial line of the car and is securely brought back into said line after having been moved away from the same either to the right or left.

RAILWAY CROSS-TIE.—G. R. MAVIS, Wymore, Neb. This invention refers to a type of ties that are formed of plate metal and concrete, and has for its object to provide novel details of construction for a tie which afford a strong, shapely tie, well adapted for railroad tracks or street railway road bed construction.

AUTOMATIC ELECTRIC RAILWAY SWITCHING DEVICE.—F. M. RICE, Dows, and A. W. HILL, Belmond, Iowa. The present invention is an improvement upon that form of switch operating device which when opened is left open after the car has passed on to the siding or branch line, leaving a dangerous condition in the main line of an open switch which prevents through travel on the main line and involves the danger of collision as well as an embarrassment of traffic; and it secures the automatic closing of the switch after the car has passed on to the siding or branch line.

CAR-WINDOW.—J. W. SCOTT, Chicago, Ill. One purpose here is to provide a construction of a car window, wherein the window may be swung open from either side to a greater or less extent and locked in its open or closed position, whereby to permit opening in a direction opposite to that in which the train is traveling, admitting of ample ventilation yet preventing ingress of cinders through the ventilating open.

METALLIC RAILROAD CROSS-TIE AND CONNECTION FOR RAILS ON TIES.—M. SHANER, Bethlehem, Pa. This patent shows a new form of tie and its rail fastening appurtenances, the tie being metal and having inwardly projecting ends bearing integral members for engaging the outside of the web and base of the rail; inward from the ends the ties groove longitudinally, receive clamping bars that extend beneath the rails and have overhanging members clamp the rails at the inside.

LIFTING-JACK.—W. A. SCOTT, J. J. KING, and C. J. BROWN, Consul, Ala. In operation, the jack is placed so that the point of the bar is inserted beneath the tie, with one of the recesses in the bar engaging the rounded portion of the base. The bar is rocked until the tie is in engagement with the base of the rail, when the handle of the bar is engaged with one of the notches in the vertical arm, thus retaining the tie in position during the driving of the spikes.

MAIL-BAG-HANDLING APPARATUS.—J. D. DOWELL, Springfield, Ill. The inclination of the track toward its discharging end and the action of the starting spring produces an acceleration of movement sufficient to overcome the momentum of the train so that when the carrier comes to a stop at the lower end of the track it would have a tendency to throw the bag off and the little kick given by the tongue of the saddle to the bag will aid in throwing the bag far enough from the railroad to avoid any injury to the delivered bag.

Pertaining to Recreation.

DRUM.—A. D. CONVERSE, Winchendon, Mass. Of the objects in this case one is to provide a construction of a metal hoop for drums that when applied to the body thereof will be offset from its outer face, and which will be very simple and economic in construction, the hoop being particularly adapted for use upon toy drums having metal heads.

TOY HORN.—A. D. CONVERSE, Winchendon, Mass. The invention refers particularly to horns known as "fish-horns," and the purpose is to provide means whereby they may be more expeditiously, durably, and attractively manufactured than heretofore, and whereby the reeds are rendered so secure as to remain in position even under severe usage.

ARTIFICIAL BAIT.—A. G. ZAMEL, Chicago, Ill. One of the objects in this invention is to provide an improved bait, affording means for protecting the hooks against fouling by weeds and similar obstructions while at the same time leaving the hooks exposed when the bait is struck by a fish. It relates more particularly to such baits as are used as lures when drawn through the water.

Pertaining to Vehicles.

END-GATE FOR WAGONS.—B. M. WILHITE, Gordon, Neb. The object here is to provide details of construction for a device for removable end gates for freight wagons; furthermore, that adapt the end gate to receive different inclinations from a vertical plane, or be dropped into pendant adjustment for opening the rear end of the wagon bed it normally closes, the gate being readily removable when in pendant adjustment.

TONGUE-TRUCK.—W. MOHR, Oklahoma, Okl. The invention relates more particularly to tongue trucks adapted to be used in connection with agricultural machinery such as harvesters, binders and the like. An object is to provide a simple, strong tongue truck for use in supporting the weight of the tongue and preventing side draft of the vehicle when the latter is in motion.

FIRE-TRUCK SIGNAL.—J. KENLON, New York, N. Y. The aim of this inventor is to provide an apparatus to be used on a fire truck by the driver and tillerman. More specifically, the object is to provide one which will indicate to the tillerman when the driver has seated himself, and which will indicate to the driver the seating of the tillerman.

VEHICLE-BRAKE. — T. ROBINO, Hazleton, Pa. One purpose of the improvement is to protect that portion of the hub to which the brake is applied, and to provide such protective agent with inserted material adapted to increase the resistance between it and the brake, and it is also a purpose to securely lock the wheels against turning when the brakes have been fully applied.

WHEEL-RETAINER AND ATTACHMENT-SUPPORT.—F. W. LECHNER, Wenona, Ill. The invention relates to improvements adapted to be attached to the end of an axle or shaft for retaining a wheel in position and also adapted to constitute a support for any suitable form of attachment or mechanism. More particularly it relates to improvements in mechanism disclosed in a previous patent granted to Mr. Lechner, and involving means for retaining the wagon wheel upon the axle and supporting a road-smoothing device.

MOTOR-VEHICLE.—J. PHILLIPS and W. A. PHILLIPS, Randolph, Wis. In this patent the invention has reference to traction engines for automobiles and other power-driven vehicles, and its object is to provide a new and improved motor vehicle, arranged to permit convenient steering and positive driving of the front wheels.

SPRING-CLIP.—F. B. SANDERS, Newington Junction, Conn. The invention relates to spring clips for vehicles and the like, and the object is to provide a clip which will securely hold the leaves of a spring in position and obviate all necessity of perforating the leaves. A further object is to provide a device which holds the spring in such a manner that all movement of the leaves longitudinally of one another is prevented.

Designs.

DESIGN FOR A HAND-BAG.—J. STEMBER, New York, N. Y. This design includes a hand-bag proper, and rather large circular handles or supports for the same one attached to each side of the article slightly below the opening and at the center. The novel position of the handles also ornamentally contributes to the graceful configuration of the bag.

DESIGN FOR A KNIT FABRIC.—C. H. FRENCH, Canton, Mass. The ornamental design in this case comprises a field of fabric mottled rather closely and uniformly around alternating ball and pear shaped forms which are very fairly mottled or flecked. The latter are the larger in area.

DESIGN FOR A BADGE.—J. E. JOHNSON, Hayfield, Iowa. In this ornamental design the badge at its upper part represents the Capitol building. Lower down hang the stars and stripes, and partly across their lower part is a wing-spread eagle grasping a sword and gun. Directly under is a Continental hat over a shield which latter forms the bottom of the badge.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10793) A. F. S. asks: What is smoke in terms of molecular physics? Is it composed of single molecules or flakes of the same, or is it a fixed chemical compound combustible or gas modified by carbonic acid? A. The visible portion of smoke is the unconsumed carbon which has passed up the chimney and is lost to the fire. It is not in molecular particles, but in masses, as any one may know who gets it into his eyes. Molecules are too small to be perceived with any of the senses. When the smoke is consumed the gases which escape from the chimney are invisible to the eye, since they contain no solid particles. The carbon is then changed into carbon dioxide—carbonic acid gas.

(10794) A. F. D. says: When I stand before a mirror, with outstretched arms, I observe that my hands are reversed—an object held in my right hand appearing in my left in the mirror. Why are not my head and feet also reversed? A. Your head and feet are reversed in a plane mirror in exactly the same sense as your hands are; that is, the image which you see in the mirror will wink its left eye if you wink your right; its left foot is opposite your right foot and is an image of your right foot, etc. The entire image of yourself as seen in a plane mirror is a reversal of yourself; it faces in the opposite direction to that in which you are facing, and looks you in the face. Your outstretched arms and hands are not upside down, in the image, and yet you seem to ask that your head and feet should exchange places and your image be seen standing on its head. This cannot be, in fairness. The image is an optical counterpart of yourself, and because it faces you, its right hand is opposed to your left hand; its right cheek and foot are opposite to the same members of your body. Each point of the image is formed by lines which enter the eye after reflection from the mirror. The image is a geometrical construction. The method of making an image can be found in all the textbooks of optics, and need not be given here; but the idea that there is any reversal in the hands which is not also to be seen in the head and feet, is quite correct. Your image in a mirror could not possibly face in the same direction as you do, so that you could see its back, as you would that of a man who stood in front of you and faced in the same direction as you did.

(10795) E. A. W. asks: Please state in your column of Notes and Queries what substance or material the coil spring is made of in the little hygrometer made in Germany. A. We have no idea to what hygrometer you refer in your inquiry for the material a little spring is made of. If it does service as a spring, it is doubtless made of steel or bronze. It is too indefinite to ask for a hygrometer made in Germany. Many forms are made there.

(10796) W. H. P. asks: I would like to ask through the medium of your Notes and Queries how frozen water pipes are thawed out, by means of electricity, without the use of storage batteries. Is the positive pole of the dynamo connected to one side of the frozen pipe and the negative to the other? If so, why is the dynamo not "short-circuited"? A. Water pipes are thawed by electricity by sending a current of the proper strength through the frozen portion till the water runs. It would not do to throw the current of a dynamo upon a short section of a water pipe. As you say, it would short-circuit the machine. A rheostat would be necessary for a direct current, and a choke coil or a transformer for the alternating current. We have published the details for the operation, to which we would refer our readers again; they are to be found in the SCIENTIFIC AMERICAN, vol. 90, No. 12, and vol. 92, No. 7, price 10 cents each mailed.

(10797) L. L. S. asks: Can you suggest to me something giving comprehensive directions for making a practical electric telephone which will work on a single-wire line (grounded) about three-eighths of a mile long? A. You will find the information you require for making a practical electric telephone in our SUPPLEMENT, No. 966, and SCIENTIFIC AMERICAN, Vol. 72, No. 7. We send these papers for ten cents each. You can operate these instruments over a single wire for a much greater distance than you specify, by grounding the wire at each end of the line, as is done in the telegraph lines.

(10798) G. W. P. asks: I am desirous of finding something about reversing the image by development in a photographic dry plate. I would like to know what experiments have been made. After exposing a plate as usual, I want the image to be a positive instead of a negative. A. The photographic image is reversed by greatly increasing the time of exposure. The image then develops as a positive instead of a negative.

NEW BOOKS, ETC.

THE UTILIZATION OF WOOD WASTE BY DISTILLATION. A General Consideration of the Industry of Wood Distilling, Including a Description of the Apparatus Used and the Principles Involved. Also Methods of Chemical Control and Disposal of the Products. By Walter B. Harper, M.S. New York: D. Van Nostrand Company. Folio; cloth; 157 pages, double column, illustrated. Price $3 net.

On the presentation of Mr. Harper's book, the deficiency of information on the utilization of wood waste need be no longer a condition in distillation matters, and particularly in the treatment of resinous woods. Those who are unscientific, or seeking investment, or already involved in the methods now in use, will find the history and discussion of all distillation features based on a thorough mechanical, chemical and industrial knowledge. The principles of distillation, the apparatus for destructive distillation, and refining methods bring the reader to the description of the numerous processes and should emphasize its chapters' entry into the field as one of vast importance in demonstrating all the practice established up to date, and this is reinforced by a surprising addition of engravings which leaves no apparatus unillustrated. The practical chapters that follow deal with the execution of the processes, the refining processes and the establishment of a plant; and the work loses neither value nor interest as it takes up finally the consideration of the scientific principles and chemical elements involved in the utilization of wood waste. The book is of a class entitled to a fair index, instead of dependence on a good table of contents.

LAYING OUT FOR BOILER MAKERS AND SHEET METAL WORKERS. A Practical Treatise on the Layout of Boilers, Stacks, Tanks, Pipes, Elbows, and Miscellaneous Sheet Metal Work. New York: The Boiler Maker. Folio; cloth; 191 pages, double column; 425 illustrations. Price, $4.

The merit of this complete work need not in the least remain conjectural for it may be immediately seen that the promise of practical application of certain principles involved in connection with "laying out" in the every-day work in all boiler shops is entirely apart from a theoretical treatment. Putting aside the claim that mastery of geometry, mechanics and kindred branches of elementary mathematics is not necessary for doing the detail work of different types of boilers, stacks, etc., the book practises the law of giving a few simple problems from which the application of the methods to more complicated problems may be quickly learned. Only those layouts which are of proximate material use are described, and the directness of the style in presenting the details of the laying out will enable boilermakers to mass their verdict of approval in the very first chapter. The volume goes on to deal with triangulation, tubular boiler, locomotive boiler, Scotch boiler, repairing locomotive and other types of boiler, steel stacks and miscellaneous problems. The compilation has the substantial ground of praise in splendid quality of paper, perfect printing, and clean illustrations of technical drawings. It would be difficult to find a large body of outline engravings presenting such an unblemished run of sections and details. The half-tone pictures of finished constructions are an important addition, but hardly rendered to equal the many good points of the book. A thorough index is furnished.

WOOD CARVING. Comprising Practical Instructions, Examples and Designs, Including 1,146 Working Drawings and Photographic Illustrations. Edited by Paul N. Hasluck. Philadelphia: David McKay. 8vo.; cloth; 568 pages, double column. Price, $3.

This is one of the latest sparks struck from the anvil of a busy editor and surely the compilation is equal in scope and merit to the best of Mr. Hasluck's numerous works. Every phase of the wood carving craft is illustrated. The artistic effects of ornamental woodwork are best reproduced by half-tone pictures and these are employed in most of the copies. In respect to these, a recommendatory feature lies in the fact that a majority of the most important reproductions is published for the first time. It is primarily an issue of very practical instruction, and the designs are of the right sort from which the carver can easily work. By the aid of a complete book of this nature and magnitude almost any one can learn to carve, or if not a student of the craft hunting for exact instructions, the reader can get a comprehensive presentation of the fascinating subject of wood as a sculptor's material. Various examples are given of the flights to which the art has been carried in widely separated countries, and the chapters

on history of wood carving, with styles of carved ornament; twenty different kinds of wood; tools and appliances; and designing for carving, are hardly less entertaining than the learned introduction to the volume. Miscellaneous panels; brackets, cabinets, frames, furniture, figures and chimney pieces are only a part of the objects entitled to separate articles in this edition of over forty chapters. An ample index is supplied.

CABINETWORK AND JOINERY. Comprising Designs and Details of Construction, with 2,021 Working Drawings and 12 Colored Plates. Edited by Paul N. Hasluck. Philadelphia: David McKay. 8vo.; cloth; 568 pages, double column. Price, $3.

Earlier readings, especially in the set uniform with the book under notice, those on Woodworking and Carpentry and Joinery should have made a beginner acquainted with hand tools and appliances; wood varieties; forms of joints and their adaptation to conditions; the setting out of work and the principles of construction in woodwork. The practice in the present volume is to make a direct and immediate appeal to the constructive instinct of a craftsman, through an extensive and varied range of designs of completed articles explained by full notes. True to this purpose the edition in every case deals in workmanlike designs and illustrates them with such plain and unerring directions that they share with the text in demonstrating the great practical character of the publication. It contains more illustrated matter than any book of its kind. If the aim of the colored plates is to show how the cabinetwork and the joinery appear in the finished article the success is pronounced and gives emphasis to the good use to which the outline engravings have been put. The foremost master-craftsmen of the present time have aided the editor and the chapters constitute stages in the general growth of the branches treated that will add materially to the constructural well-being of the craft. A large technical index is a vital addition to a volume of this class.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE

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Gun sight, F. Hendrickson 890,980
Gun sight, D. B. Harris 891,063
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Inquiry No. 8728.—Wanted the address of The Frear Novelty Co.

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Inquiry No. 8730.—Wanted a 10 to 30 horse-power gasoline, kerosene engine, mounted on a ¾ to 4 ton cast-iron truck with dirt road wheels.

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Inquiry No. 8737.—For manufacturers of machinery for making tooth-brushes, shaving brushes, galvanized water buckets, locks, nibs and holders.

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Inquiry No. 8742.—For manufacturers of water still, also of thermometer tubing.

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Switch lock, W. Anderson	891,129
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Switch throwing mechanism, electric, W. H. Turner	890,942
Syringe, A. E. Macdonald	890,999
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Table lock, extension, E. Tyden	890,732
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Tamping machine, A. F. Kellner	890,659
Target spotter, R. S. Henry	890,647
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